

# Search Report

EIC 1700

STIC Database Tracking Number: 22367630

To: MICHAEL BERNSHTEYN

Location: REM-10D25

Art Unit: 1713

Thursday, September 06, 2007

Case Serial Number: 10/530965

From: MEI HUANG

Location: EIC1700

REM-4B28 / REM-4B31

Phone: (571)272-3952

[mei.huang@uspto.gov](mailto:mei.huang@uspto.gov)

## Search Notes

Examiner BERNSHTEYN:

Please feel free to contact me if you have any questions or if you would like to refine the search query. Thank you for using STIC services!

Regards,  
Mei



SCIENTIFIC REFERENCE BR  
Sci & Tech Inf. Ctr.  
SEP 01  
Pat. & T.M. Office

Re187

Losek

Access DB# 2360480

## SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Michael Bernshteyn Examiner #: 81515 Date: 09/05/07  
Art Unit: 1713 Phone Number 30\_272-2411 Serial Number: 10/530,965  
Mail Box and Bldg/Room Location: Rm 10025 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Composite ion-exchange membrane  
Inventors (please provide full names): Kota Kitamura; Yoshimitsu Sakaguchi;  
Shigerori Nagahara, Shiro Hamamoto; Naohiko Takimoto, etc.  
Earliest Priority Filing Date: 10/17/2002

\*For Sequence Searches Only\* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

*Please try to find all compound of Zoromulas 2A, 2B, and 3-7 according the limitations of claims 2-7 and 20-28.*

Thank you  
*M. Bernshteyn,*

<b>STAFF USE ONLY</b>		<b>Type of Search</b>	<b>Vendors and cost where applicable</b>
Searcher:	<u>MH</u>	NA Sequence (#)	STN
Searcher Phone #:		AA Sequence (#)	Dialog
Searcher Location:		Structure (#)	Questel/Orbit
Date Searcher Picked Up:	<u>9/6/07</u>	Bibliographic	Dr. Link
Date Completed:	<u>9/6/07</u>	Litigation	Lexis/Nexis
Searcher Prep & Review Time:		Fulltext	Sequence Systems
Clerical Prep Time:		Patent Family	WWW/Internet
Online Time:		Other	Other (specify)

10/530, 965

In the Claims:

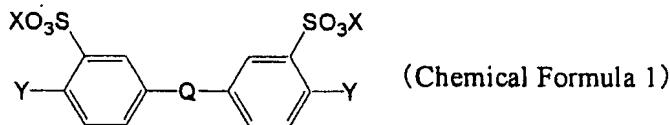
Amend the claims as follows:

1. (Original) A composite ion exchange membrane comprising an ion exchange resin composition, and a support membrane having a continuous pore penetrating the support membrane, wherein

said support membrane is a support membrane which accepts said ion exchange resin composition within said pore, and

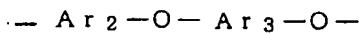
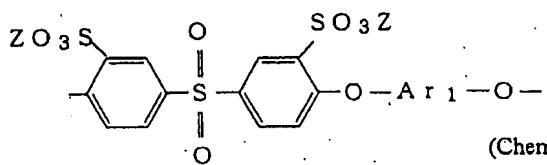
said ion exchange resin composition is an ion exchange resin composition which contains an ion exchange resin containing, as a main component, an aromatic polyether and/or its derivative, the aromatic polyether being obtained by mixing a monomer component which contains, as main ingredients, a compound represented by Chemical Formula 1, an aromatic dihalogenated compound and a bisphenol compound with a carbonate and/or a bicarbonate of an alkali metal and polymerizing the mixture in an organic solvent:

(in Chemical Formula 1, Q represents a  $-S(=O)_2-$  group or a  $-C(=O)-$  group; X represents an H atom, an Li atom, an Na atom or a K atom; and Y represents an F atom, a Cl atom, a Br atom or an I atom).



2. (Original) A composite ion exchange membrane comprising an ion exchange resin composition, and a support membrane having a continuous pores penetrating the support membrane, wherein said support membrane is a support membrane which accepts said ion exchange resin composition within said pore, and said ion exchange resin composition is an ion exchange resin composition which contains an ion exchange resin including linking units represented by Chemical Formula 2A and linking units represented by Chemical Formula 2B at a ratio,

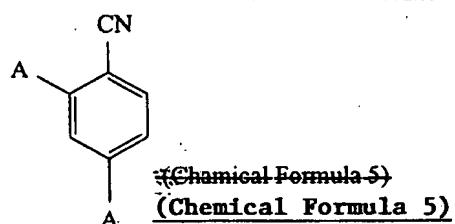
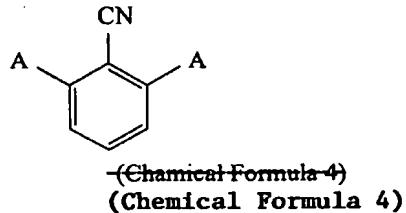
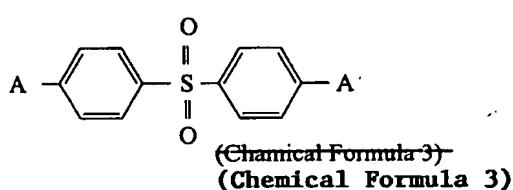
Chemical Formula 2A : Chemical Formula 2B = n : m, respectively:



(Chemical Formula 2B)

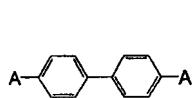
(in Chemical Formulas 2A and 2B, Z represents H, Li, Na, K or a cation derived from an aliphatic or aromatic amine; Ar<sub>1</sub> and Ar<sub>3</sub> independently represent one or more kinds of bivalent organic group; Ar<sub>2</sub> represents one or more kinds of bivalent organic group including an aromatic ring having an electron-withdrawing group; and n and m represent an integer within a range of 1 to 1000 and an integer within a range of 0 to 1000, respectively).

3. (Currently amended) The composite ion exchange membrane according to claim 2, wherein said Ar<sub>2</sub> is one or more kinds of linking unit selected from the group consisting of linking units represented by Chemical Formula 3, Chemical Formula 4 and Chemical Formula 5:

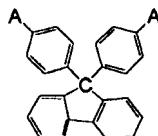


(in Chemical Formulas 3 to 5, A represents in each occurrence a linking site with another linking unit).

4. (Currently amended) The composite ion exchange membrane according to claim 2, wherein said Ar<sub>1</sub> and said Ar<sub>3</sub> each are one or more kinds of linking unit selected independently from the group consisting of linking units represented by Chemical Formula 6 and Chemical Formula 7:



(Chemical Formula 6)  
(Chemical Formula 6)



(Chemical Formula 7)  
(Chemical Formula 7)

(in Chemical Formula 6 and Chemical Formula 7, A represents in each occurrence a linking site with another linking unit).

5. (Original) The composite ion exchange membrane according to claim 2, wherein said Ar<sub>1</sub> and said Ar<sub>3</sub> each are a linking unit represented by said Chemical Formula 6, said Ar<sub>2</sub> is a linking unit represented by said Chemical Formula 3, and said n and said m each are an integer within a range of 1 to 1000 which satisfies Mathematical Expression 1:

$$0.2 \leq n/(n + m) \leq 0.8 \text{ (Mathematical Expression 1).}$$

6. (Original) The composite ion exchange membrane according to claim 2, wherein said Ar<sub>1</sub> and said Ar<sub>3</sub> each are a linking unit represented by said Chemical Formula 6, said Ar<sub>2</sub> is a linking unit represented by said Chemical Formula 4, and said n and said m each are an integer within a range of 1 to 1000 which satisfies Mathematical Expression 2:

$$0.2 \leq n/(n + m) \leq 0.8 \text{ (Mathematical Expression 2).}$$

7. (Original) The composite ion exchange membrane according to claim 2, wherein said Ar<sub>1</sub> and said Ar<sub>3</sub> each are a linking unit represented by said Chemical Formula 7, said Ar<sub>2</sub> is a linking unit represented by said Chemical Formula 3, and said n and said m each are an integer within a range of 1 to 1000 which satisfies

20. (New) The composite ion exchange membrane according to claim 2, which has a surface layer comprising said ion exchange resin composition on each side of said support membrane.

21. (New) The composite ion exchange membrane according to claim 20, wherein the thickness of each of said surface layers is within a range of 1 to 50 µm and also is within a range which does not exceed half the total thickness of said composite ion exchange membrane.

22. (New) The composite ion exchange membrane according to claim 20, wherein at least one surface of said support membrane has an aperture ratio within a range of 40 to 95%.

23. (New) The composite ion exchange membrane according to claim 20, wherein said support membrane contains a polybenzazole-type polymer as a material.

24. (New) The composite ion exchange membrane according to claim 21, wherein said support membrane contains a polybenzazole-type polymer as a material.

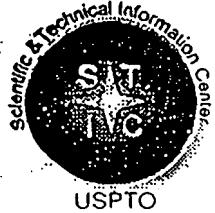
25. (New) The composite ion exchange membrane according to claim 22, wherein said support membrane contains a polybenzazole-type polymer as a material.

26. (New) The composite ion exchange membrane according to claim 23, wherein said support membrane is obtained by shaping an isotropic solution containing said polybenzazole-type polymer in a content within a range of 0.5 to 2% by mass into film and then solidifying the solution.

27. (New) The composite ion exchange membrane according to claim 2, wherein when a straight line running through the composite ion exchange membrane along its thickness direction is set in an analysis area in a cross section of said composite ion exchange membrane and a linear analysis for elements contained only

in the ion exchange resin is conducted using an electron probe microanalyzer, the variation in the number of X-ray counted, as indicated in CV value, is within 50%.

28. (New) The composite ion exchange membrane according to claim 2, wherein when a straight line running through the composite ion exchange membrane along its thickness direction is set in an analysis area in a cross section of said composite ion exchange membrane and a linear analysis for elements contained only in the ion exchange resin is conducted using an electron probe microanalyzer, the number of the analysis points where the number of the counted X-rays of the analyzed elements is 5% or less relative to the maximum number is within a range of 0 to 30% of the number of all the analysis points.



# STIC Search Results Feedback Form

EIC17000

Questions about the scope or the results of the search? Contact the EIC searcher or contact:

Kathleen Fuller, EIC 1700 Team Leader  
571/272-2505 REMSEN 4B28

## Voluntary Results Feedback Form

- I am an examiner in Workgroup:  Example: 1713.
- Relevant prior art found, search results used as follows:
  - 102 rejection
  - 103 rejection
  - Cited as being of interest.
  - Helped examiner better understand the invention.
  - Helped examiner better understand the state of the art in their technology.

Types of relevant prior art found:

- Foreign Patent(s)
- Non-Patent Literature  
(journal articles, conference proceedings, new product announcements etc.)

➤ Relevant prior art not found:

- Results verified the lack of relevant prior art (helped determine patentability).
- Results were not useful in determining patentability or understanding the invention.

Comments:

Drop off or send completed forms to EIC1700 REMSEN 4B28

=> fil reg  
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STRUCTURE FILE UPDATES: 5 SEP 2007 HIGHEST RN 946114-43-8  
DICTIONARY FILE UPDATES: 5 SEP 2007 HIGHEST RN 946114-43-8

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=> d 117 que stat  
L3 STR  

8	6	11
O	O	O
O---S~~Cy~~S~~Cb~~S---O		
10    2    4    13		
O	O	O
9	7	12

#### NODE ATTRIBUTES:

DEFAULT MLEVEL IS ATOM  
GGCAT IS MCY UNS AT 2  
GGCAT IS MCY UNS AT 4  
DEFAULT ECLEVEL IS LIMITED

#### GRAPH ATTRIBUTES:

RING(S) ARE ISOLATED OR EMBEDDED  
NUMBER OF NODES IS 13

STEREO ATTRIBUTES: NONE  
L4 STR

O~~C C~~O  
1 2 3 4

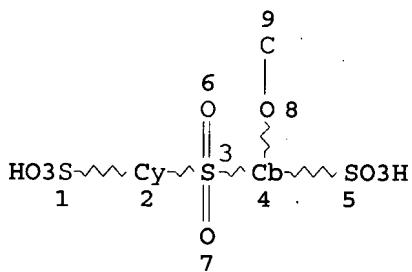
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NSPEC IS RC AT 3  
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DEFAULT ECLEVEL IS LIMITED

#### GRAPH ATTRIBUTES:

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NUMBER OF NODES IS 4

STEREO ATTRIBUTES: NONE  
L5 SCR 2043  
L9 337 SEA FILE=REGISTRY SSS FUL L3 AND L4 AND L5  
L15 STR



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DEFAULT ECLEVEL IS LIMITED

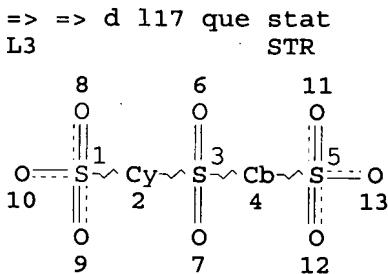
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STEREO ATTRIBUTES: NONE  
L17 37 SEA FILE=REGISTRY SUB=L9 SSS FUL L15

100.0% PROCESSED 332 ITERATIONS  
SEARCH TIME: 00.00.01

37 ANSWERS



## NODE ATTRIBUTES:

DEFAULT MLEVEL IS ATOM  
GGCAT IS MCY UNS AT 2  
GGCAT IS MCY UNS AT 4  
DEFAULT ECLEVEL IS LIMITED

GRAPH ATTRIBUTES:  
RING(S) ARE ISOLATED OR EMBEDDED  
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STEREO ATTRIBUTES: NONE

L4 STR

O~~C C~~O  
1 2 3 4

NODE ATTRIBUTES:

NSPEC IS RC AT 2  
NSPEC IS RC AT 3  
DEFAULT MLEVEL IS ATOM  
DEFAULT ECLEVEL IS LIMITED

GRAPH ATTRIBUTES:

RING(S) ARE ISOLATED OR EMBEDDED  
NUMBER OF NODES IS 4

STEREO ATTRIBUTES: NONE

L5 SCR 2043  
L9 337 SEA FILE=REGISTRY SSS FUL L3 AND L4 AND L5  
L12 STR

O—C C—O  
1 2 3 4

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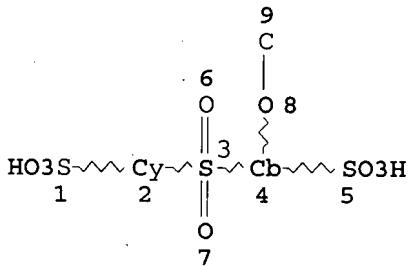
NSPEC IS RC AT 2  
NSPEC IS RC AT 3  
DEFAULT MLEVEL IS ATOM  
DEFAULT ECLEVEL IS LIMITED

GRAPH ATTRIBUTES:

RING(S) ARE ISOLATED OR EMBEDDED  
NUMBER OF NODES IS 4

STEREO ATTRIBUTES: NONE

L15 STR



NODE ATTRIBUTES:

NSPEC IS RC AT 9  
DEFAULT MLEVEL IS ATOM  
GGCAT IS MCY UNS AT 2  
GGCAT IS MCY UNS AT 4  
DEFAULT ECLEVEL IS LIMITED

GRAPH ATTRIBUTES:

RING(S) ARE ISOLATED OR EMBEDDED  
NUMBER OF NODES IS 9

STEREO ATTRIBUTES: NONE

L17 37 SEA FILE=REGISTRY SUB=L9 SSS FUL L15 AND L12

100.0% PROCESSED 332 ITERATIONS  
 SEARCH TIME: 00.00.01

37 ANSWERS

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(FILE 'HOME' ENTERED AT 13:24:22 ON 06 SEP 2007)

FILE 'HCAPLUS' ENTERED AT 13:24:29 ON 06 SEP 2007  
 L1 1 SEA ABB=ON PLU=ON US2006241192/PN  
     SEL RN

FILE 'REGISTRY' ENTERED AT 13:24:54 ON 06 SEP 2007  
 L2 5 SEA ABB=ON PLU=ON (146673-89-4/B1 OR 267877-35-0/B1 OR  
     60871-72-9/B1 OR 681035-31-4/B1 OR 75-75-2/B1)  
     D SCA

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 L3 STR  
 L4 STR

FILE 'REGISTRY' ENTERED AT 13:42:18 ON 06 SEP 2007  
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 L6 17 SEA SSS SAM L3 AND L4 AND L5  
 L7 STR L3  
 L8 17 SEA SSS SAM L7 AND L4 AND L5  
 L9 337 SEA SSS FUL L3 AND L4 AND L5  
     SAV L9 BER965/A  
 L10 3 SEA ABB=ON PLU=ON L2 AND L9

FILE 'LREGISTRY' ENTERED AT 13:48:08 ON 06 SEP 2007  
 L11 STR L3  
 L12 STR L4

FILE 'REGISTRY' ENTERED AT 13:54:12 ON 06 SEP 2007  
 L13 15 SEA SUB=L9 SSS SAM L11 AND L12  
 L14 302 SEA SUB=L9 SSS FUL L11 AND L12  
     SAV L14 BER965S1/A

FILE 'LREGISTRY' ENTERED AT 14:18:28 ON 06 SEP 2007  
 L15 STR L11

FILE 'REGISTRY' ENTERED AT 14:45:06 ON 06 SEP 2007  
 L16 1 SEA SUB=L9 SSS SAM L15 AND L12  
 L17 37 SEA SUB=L9 SSS FUL L15 AND L12

FILE 'HCAPLUS' ENTERED AT 14:46:48 ON 06 SEP 2007  
 L18 85 SEA ABB=ON PLU=ON L10  
 L19 29 SEA ABB=ON PLU=ON L17  
 L20 QUE ABB=ON PLU=ON MEMBRAN?  
 L21 75 SEA ABB=ON PLU=ON L18 AND L20  
 L22 QUE ABB=ON PLU=ON (ION OR CATION OR ANION) (2A) EXCHANG?  
 L23 43 SEA ABB=ON PLU=ON L21 AND L22  
 L24 11 SEA ABB=ON PLU=ON L23 AND (PY<=2003 OR PRY<=2003 OR  
     AY<=2003)  
 L25 40 SEA ABB=ON PLU=ON L24 OR L19

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 FILE LAST UPDATED: 5 Sep 2007 (20070905/ED)

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=> d 119 ibib abs hitstr hitind 1-29

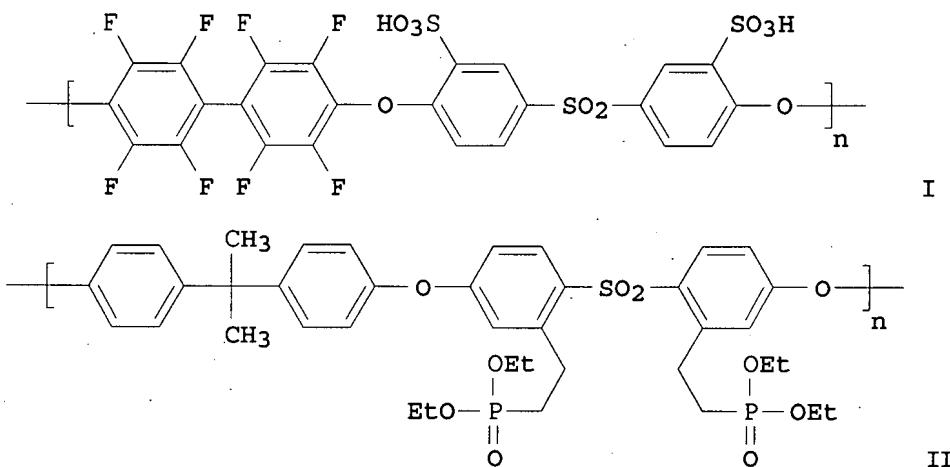
L19 ANSWER 1 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2007:357845 HCAPLUS  
 DOCUMENT NUMBER: 146:380936  
 TITLE: Mixtures of sulfonated and phosphonated polymers as high temperature membranes for fuel cells  
 INVENTOR(S): Haering, Thomas  
 PATENT ASSIGNEE(S): Driess, Stefan, Michael, UK  
 SOURCE: PCT Int. Appl., 34pp.  
 CODEN: PIIXD2  
 DOCUMENT TYPE: Patent  
 LANGUAGE: German  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	-----	-----	-----	-----
WO 2007034337	A2	20070329	WO 2006-IB3879	200609 22

W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA,  
 CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,  
 GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG,  
 KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA,  
 MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG,  
 PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY,  
 TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW  
 RW: AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU,  
 IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR,  
 BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD,  
 TG, BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,  
 ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

PRIORITY APPLN. INFO.: WO 2006-IB3879  
 200609

GI



**AB** Blends of sulfonated, partially fluorinated or non-fluorinated aromatic polymers such as, an example, I and sulfonated or/and phosphonated statistical or block aromatic polymers in which sulfonate and phosphonate groups being bonded either directly to the aromatic main chain or, at the end of an alkyl or perfluoroalkyl side chain such as, an example, II are used as membranes in high temperature ( $\geq 100^\circ$ ) fuel cells. Thus, a typical membrane is prepared by mixing a solution 2.75 g sulfonated, partially fluorinated polyether sulfone in 24.75 g NMP and 0.25 g phosphonated polysulfone in 2.25 g NMPO and coating onto a glass substrate followed by removing a solvent at 130°. The resulting membrane was treated in water bag with 10% HBr 8 h to hydrolyze phosphonates and with water 48 h at 60°.

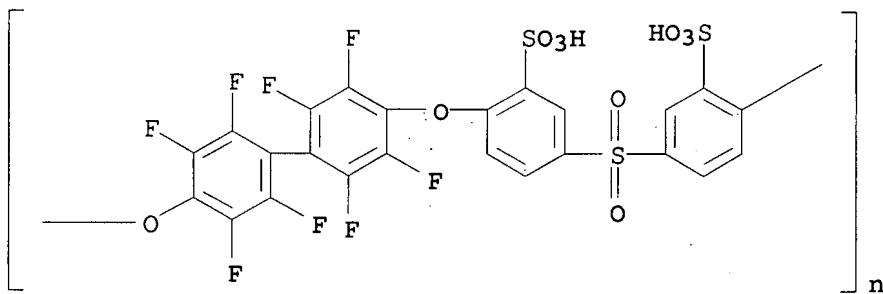
**IT** 930786-15-5

RL: POF (Polymer in formulation); TEM (Technical or engineered material use); USES (Uses)

(blend with phosphonated polymers; blends of sulfonated, partially fluorinated sulfonated or/and phosphonated statistical or blocked aromatic polymers as membranes in high temperature fuel cells)

**RN** 930786-15-5 HCPLUS

**CN** Poly[oxy(2,2',3,3',5,5',6,6'-octafluoro[1,1'-biphenyl]-4,4'-diyl)oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)] (CA INDEX NAME)



IC ICM C08L

CC 37-6 (Plastics Manufacture and Processing)

IT 930786-15-5

RL: POF (Polymer in formulation); TEM (Technical or engineered material use); USES (Uses)

(blend with phosphonated polymers; blends of sulfonated, partially fluorinated sulfonated or/and phosphonated statistical or blocked aromatic polymers as membranes in high temperature fuel cells)

L19 ANSWER 2 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2007:318192 HCPLUS

DOCUMENT NUMBER: 146:482866

TITLE: Synthesis and characterization of sulfonated-fluorinated, hydrophilic-hydrophobic multiblock copolymers for proton exchange membranes

AUTHOR(S): Yu, Xiang; Roy, Abhishek; Dunn, Stuart; Yang, Juan; McGrath, James E.

CORPORATE SOURCE: Macromolecules and Interfaces Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA

SOURCE: Macromolecular Symposia (2006), 245/246 (World Polymer Congress--MACRO 2006), 439-449

CODEN: MSYMEC; ISSN: 1022-1360

PUBLISHER: Wiley-VCH Verlag GmbH &amp; Co. KGaA

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Nanophase separated ionic-hydrophobic block copolymers may be more suitable as proton exchange membranes than random copolymers. A series of multiblock copolymers, composed of alternating segments of fully disulfonated poly(arylene ether sulfone) and highly fluorinated poly(arylene ether sulfone), were synthesized from hydrophilic and hydrophobic telechelic oligomers having a variation of mol. wts. The high reactivity of the fluorinated oligomers made unnecessary the use of high reaction temps., and thus the coupling reactions may be free of ether-ether interchange side reactions. The copolymers were characterized with regard to proton conductivity, water uptake and self-diffusion coefficient of water, and the results were compared to those of Nafion and a partially disulfonated BPSH-35 random copolymer.

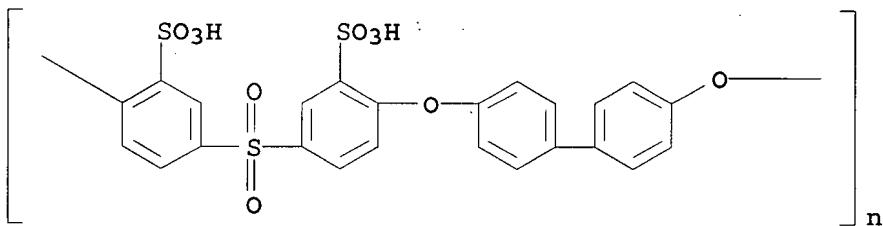
IT 751480-76-9P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)

(oligomer; preparation of sulfonated, fluorinated, and hydrophilic-hydrophobic multiblock copolymers for proton exchange membranes)

RN 751480-76-9 HCPLUS

CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)] (CA INDEX NAME)



CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 52

IT 681849-12-7P, Bis(4-hydroxyphenyl) sulfone-decafluorobiphenyl copolymer 751480-76-9P 911358-39-9P 935761-56-1P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)

(oligomer; preparation of sulfonated, fluorinated, and hydrophilic-hydrophobic multiblock copolymers for proton exchange membranes)

REFERENCE COUNT: 19 THERE ARE 19 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L19 ANSWER 3 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2007:223810 HCAPLUS

DOCUMENT NUMBER: 146:299214

TITLE: Fuel cell catalysts containing carbonaceous materials, their films, membrane-electrode assemblies, and polymer electrolyte fuel cells

INVENTOR(S): Inasaki, Takeshi; Nomura, Kimiatsu

PATENT ASSIGNEE(S): Fuji Photo Film Co., Ltd., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 64pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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JP 2007053086	A	20070301	JP 2006-199261	200607 21
PRIORITY APPLN. INFO.:			JP 2005-211856	A 200507 21

AB The catalysts contain carbonaceous material supports bonded to polymers bearing solvolysis- and heat-resistant groups, and ionic functional groups via solvolysis- and heat-resistant linkages. The films contain the catalysts, solid electrolytes, and optionally other carbonaceous material-containing catalysts without the polymers. The membrane-electrode assemblies show high catalyst utilization efficiency and good durability.

IT 146673-85-0DP, reaction product with bromopentoxylated

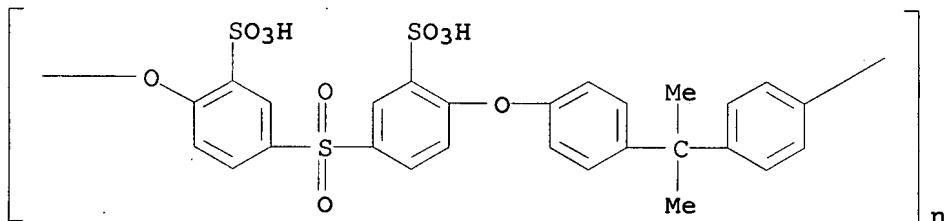
carbon black or carbon nanotube 927679-96-7DP, reaction product with bromopentoxylated carbon black

RL: CAT (Catalyst use); IMF (Industrial manufacture); PREP (Preparation); USES (Uses)

(catalyst films containing carbonaceous materials with ionic functional groups for polymer electrolyte fuel cells)

RN 146673-85-0 HCPLUS

CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy-1,4-phenylene(1-methylethylidene)-1,4-phenylene sodium salt (1:2)] (CA INDEX NAME)

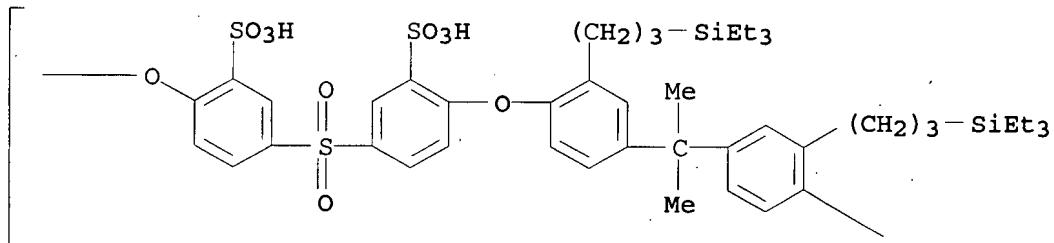


●2 Na

RN 927679-96-7 HCPLUS

CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy[2-[3-(triethylsilyl)propyl]-1,4-phenylene](1-methylethylidene)[3-[3-(triethylsilyl)propyl]-1,4-phenylene] sodium salt (1:2)] (CA INDEX NAME)

PAGE 1-A



●2 Na

PAGE 1-B

n

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 38

IT 111-24-0DP, 1,5-Dibromopentane, reaction product with carbon black and sulfo-containing polyether-polysulfone 3229-00-3DP, Pentaerythrityl tetrabromide, reaction product with carbon black and sulfo- and triethylsilyl-containing polyether-polysulfone 7440-06-4P, Platinum, uses 25135-51-7DP, reaction product with carbon black bromo derivative, chloromethylated, graft polymer with lithium sulfopropylloxystyrene and trimethylsilyloxyxystyrene, hydrolyzed 25154-01-2DP, reaction product with carbon black bromo derivative, chloromethylated, graft polymer with lithium sulfopropylloxystyrene and trimethylsilyloxyxystyrene, hydrolyzed 72355-90-9DP, reaction product with bromopentoxylated carbon black or carbon nanotube 146673-85-0DP, reaction product with bromopentoxylated carbon black or carbon nanotube 342047-78-3DP, reaction product with bromopentoxylated carbon black 342047-79-4DP, reaction product with bromopentoxylated carbon black 904911-37-1DP, graft copolymer with carbon black-bound chloromethylated polyether-polysulfone and trimethylsilylpropylloxystyrene, hydrolyzed 927679-95-6DP, reaction product with bromopentoxylated carbon black 927679-96-7DP, reaction product with bromopentoxylated carbon black 927679-98-9DP, graft copolymer with carbon black-bound chloromethylated polyether-polysulfone and lithium sulfopropylloxystyrene, hydrolyzed 927679-99-0DP, reaction product with carbon black  
 RL: CAT (Catalyst use); IMF (Industrial manufacture); PREP (Preparation); USES (Uses)  
 (catalyst films containing carbonaceous materials with ionic functional groups for polymer electrolyte fuel cells)

L19 ANSWER 4 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2007:40436 HCAPLUS  
 DOCUMENT NUMBER: 146:296321  
 TITLE: Multiblock copolymers of poly(2,5-benzophenone) and disulfonated poly(arylene ether sulfone) for proton-exchange membranes. I. Synthesis and characterization  
 AUTHOR(S): Wang, Hang; Badami, Anand S.; Roy, Abhishek; McGrath, James E.  
 CORPORATE SOURCE: Macromolecules and Interfaces Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA  
 SOURCE: Journal of Polymer Science, Part A: Polymer Chemistry (2006), Volume Date 2007, 45(2), 284-294  
 CODEN: JPACEC; ISSN: 0887-624X

PUBLISHER: John Wiley & Sons, Inc.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Nanophase-separated, hydrophilic-hydrophobic multiblock copolymers are promising proton-exchange-membrane materials because of their ability to form various morphol. structures that enhance transport. A series of poly(2,5-benzophenone)-activated, telechelic aryl fluoride oligomers with different block mol. wts. were successfully synthesized by the Ni(0)-catalyzed coupling of 2,5-dichlorobenzophenone and the end-capping agent 4-chloro-4'-fluorobenzophenone. These telechelic oligomers (hydrophobic) were then copolymerd. with phenoxide-terminated, disulfonated poly(arylene ether sulfone)s (hydrophilic) by nucleophilic, aromatic substitution to form hydrophilic-hydrophobic multiblock copolymers. High-mol.-weight multiblock copolymers with number-average block lengths ranging from 3000 to 10,000 g/mol were successfully synthesized. Two sep. glass-transition temps. were observed via differential scanning calorimetry in the transparent multiblock copolymer films when each block length was longer than 6000 g/mol. Tapping-mode atomic force microscopy also showed clear nanophase separation between the hydrophilic and hydrophobic domains and the influence of the block length as it increased from 6000 to 10,000 g/mol. Transparent and creasable films were solvent-cast and exhibited moderate proton conductivity and low water uptake. These copolymers are promising candidates for high-temperature proton-exchange membranes in fuel cells, which will be reported sep. in part II of this series.

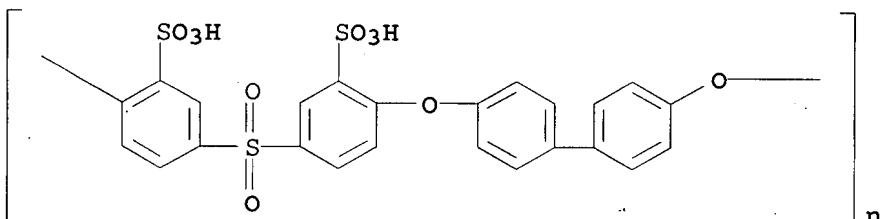
IT 701915-80-2DP, 4,4'-Biphenol-disodium 3,3'-disulfonate-4,4'-dichlorodiphenylsulfone copolymer, sru, potassium-exchanged

RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)

(prepolymer; preparation and characterization of multiblock copolymers of poly(benzophenone) and disulfonated poly(arylene ether sulfone) for proton-exchange membranes)

RN 701915-80-2 HCAPLUS

CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene) sodium salt (1:2)] (CA INDEX NAME)



●2 Na

CC 35-5 (Chemistry of Synthetic High Polymers)

Section cross-reference(s): 38

IT 2069-48-9DP, 4-Chloro-4'-fluorobenzophenone, reaction products with poly(benzophenone) 150347-09-4DP, 2,5-Dichlorobenzophenone homopolymer, reaction products with chlorofluorobenzophenone 389600-31-1DP, 4,4'-Biphenol-disodium 3,3'-disulfonate-4,4'-dichlorodiphenylsulfone copolymer, potassium-exchanged

530134-81-7DP, reaction products with chlorofluorobenzophenone  
 701915-80-2DP, 4,4'-Biphenol-disodium 3,3'-disulfonate-4,4'-  
 dichlorodiphenylsulfone copolymer, sru, potassium-exchanged  
 RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation);  
 PREP (Preparation); RACT (Reactant or reagent)  
 (prepolymer; preparation and characterization of multiblock copolymers  
 of poly(benzophenone) and disulfonated poly(arylene ether  
 sulfone) for proton-exchange membranes)

REFERENCE COUNT: 28 THERE ARE 28 CITED REFERENCES AVAILABLE  
 FOR THIS RECORD. ALL CITATIONS AVAILABLE  
 IN THE RE FORMAT

L19 ANSWER 5 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2006:1135706 HCAPLUS

DOCUMENT NUMBER: 146:103841

TITLE: Improved performance of sulfonated polyarylene  
 ethers for proton exchange membrane fuel cells

AUTHOR(S): Xing, D.; Kerres, J.

CORPORATE SOURCE: Institut fuer Chemische Verfahrenstechnik (ICVT),  
 Universitaet Stuttgart, Stuttgart, Germany

SOURCE: Polymers for Advanced Technologies (2006),  
 17(7-8), 591-597

CODEN: PADTE5; ISSN: 1042-7147

PUBLISHER: John Wiley & Sons Ltd.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB The performances of polyarylene ethers and sulfonated polyarylene  
 ethers having different backbone structures and sulfonated position  
 were comparatively studied focusing on the determination of the proton  
 conductivity, thermal and chemical stability. The sulfone groups in polymer  
 backbones are highly thermal stable. The sulfonic acid group at the  
 metasulfone position had better thermal, chemical stability and higher  
 proton conductivity than those at the ortho-ether and ortho-sulfone  
 position. Stability is meta-sulfone sulfonated polyphenyl sulfone  
 (SPSU) > ortho-sulfone SPSU >> ortho-ether SPSU. The knowledge of  
 these parameters will give sulfonated arylene main-chain ionomers  
 that are optimized for application in fuel cells. Also different  
 sulfonated polyphenyl sulfone-4,4'-biphenol/polybenzimidazole  
 (SPSU-BP/PBI) acid-base crosslinked blend membranes were studied.  
 The SPSU/PBI crosslinked blend membranes had better mech. stability  
 than their parent membrane while maintaining good thermal stability  
 and having suitable proton conductivity

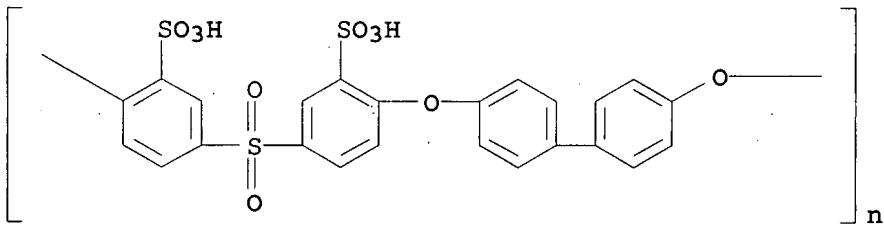
IT 751480-76-9DP, propylammonium salts

RL: POF (Polymer in formulation); PRP (Properties); SPN (Synthetic  
 preparation); TEM (Technical or engineered material use); PREP  
 (Preparation); USES (Uses)

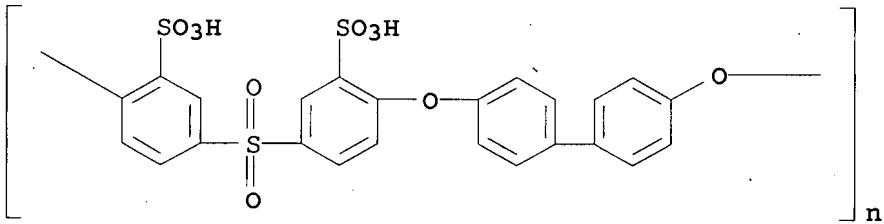
(blends with polybenzimidazole; improved performance of  
 sulfonated polyarylene ethers for proton exchange membrane fuel  
 cells)

RN 751480-76-9 HCAPLUS

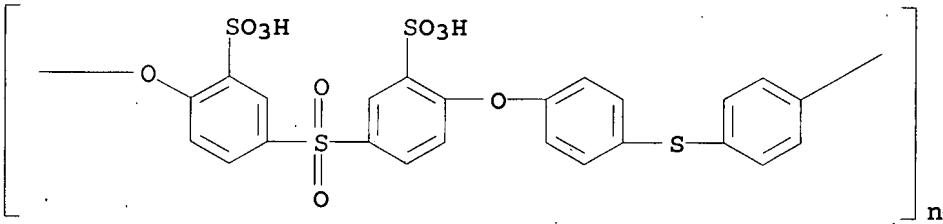
CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-  
 phenylene)sulfonyl(3-sulfo-1,4-phenylene)] (CA INDEX NAME)



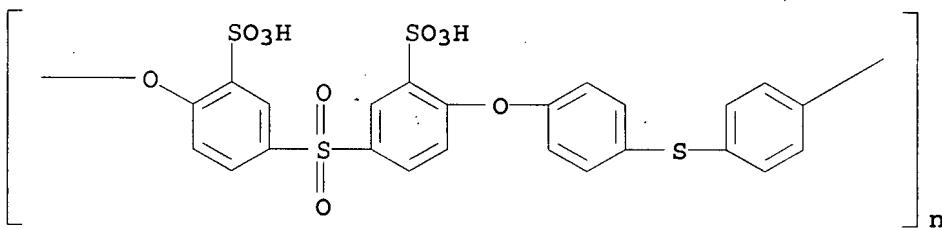
IT 751480-76-9P 912548-45-9P  
 RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation);  
 PREP (Preparation); RACT (Reactant or reagent)  
 (improved performance of sulfonated polyarylene ethers for proton  
 exchange membrane fuel cells)  
 RN 751480-76-9 HCPLUS  
 CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-  
 phenylene)sulfonyl(3-sulfo-1,4-phenylene)] (CA INDEX NAME)



RN 912548-45-9 HCPLUS  
 CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy-  
 1,4-phenylenethio-1,4-phenylene] (CA INDEX NAME)

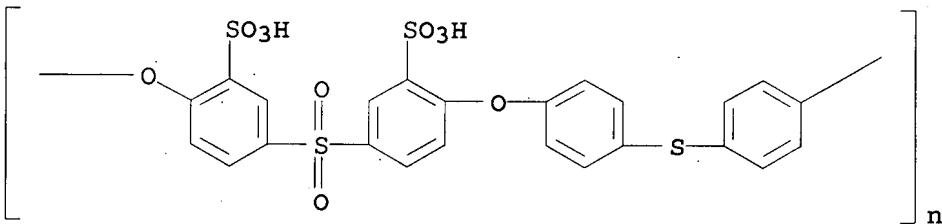


IT 917865-39-5P  
 RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation);  
 RACT (Reactant or reagent)  
 (improved performance of sulfonated polyarylene ethers for proton  
 exchange membrane fuel cells)  
 RN 917865-39-5 HCPLUS  
 CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy-  
 1,4-phenylenethio-1,4-phenylene sodium salt (1:2)] (CA INDEX NAME)



## ●2 Na

- IT 912548-45-9DP, proton-exchanged and propylammonium salts  
 RL: POF (Polymer in formulation); PRP (Properties); RCT (Reactant);  
 SPN (Synthetic preparation); TEM (Technical or engineered material  
 use); PREP (Preparation); RACT (Reactant or reagent); USES (Uses)  
 (neat and blends with polybenzimidazole; improved performance of  
 sulfonated polyarylene ethers for proton exchange membrane fuel  
 cells)
- RN 912548-45-9 HCPLUS
- CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy-  
 1,4-phenylenethio-1,4-phenylene] (CA INDEX NAME)



- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 35, 36, 38, 77
- IT 751480-76-9DP, propylammonium salts  
 RL: POF (Polymer in formulation); PRP (Properties); SPN (Synthetic  
 preparation); TEM (Technical or engineered material use); PREP  
 (Preparation); USES (Uses)  
 (blends with polybenzimidazole; improved performance of  
 sulfonated polyarylene ethers for proton exchange membrane fuel  
 cells)
- IT 751480-76-9P 912548-45-9P 917865-38-4P  
 RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation);  
 PREP (Preparation); RACT (Reactant or reagent)  
 (improved performance of sulfonated polyarylene ethers for proton  
 exchange membrane fuel cells)
- IT 301155-59-9P 917865-39-5P  
 RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation);  
 RACT (Reactant or reagent)  
 (improved performance of sulfonated polyarylene ethers for proton  
 exchange membrane fuel cells)
- IT 912548-45-9DP, proton-exchanged and propylammonium salts  
 917865-38-4DP, proton-exchanged and propylammonium salts  
 RL: POF (Polymer in formulation); PRP (Properties); RCT (Reactant);  
 SPN (Synthetic preparation); TEM (Technical or engineered material

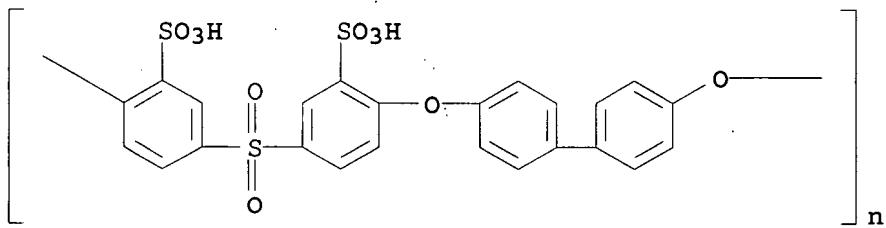
use); PREP (Preparation); RACT (Reactant or reagent); USES (Uses) (neat and blends with polybenzimidazole; improved performance of sulfonated polyarylene ethers for proton exchange membrane fuel cells)

REFERENCE COUNT: 20 THERE ARE 20 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L19 ANSWER 6 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2006:1118630 HCAPLUS  
 DOCUMENT NUMBER: 145:422681  
 TITLE: Proton-conductive sulfonated polysulfones having superior durability for fuel cell electrolytes  
 INVENTOR(S): Yamaguchi, Takehisa; Ji, Mi; Yamashita, Koichi  
 PATENT ASSIGNEE(S): Tokyo University, Japan  
 SOURCE: Jpn. Kokai Tokkyo Koho, 19pp.  
 CODEN: JKXXAF  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

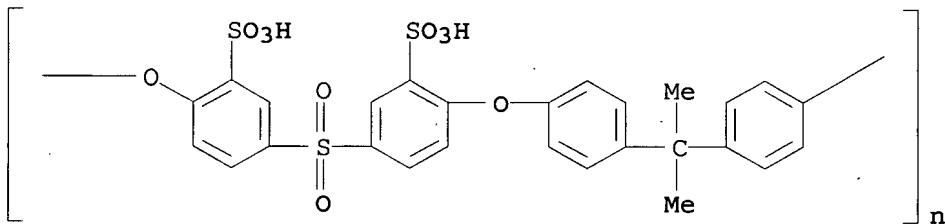
PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2006291046	A	20061026	JP 2005-113995	200504 11
PRIORITY APPLN. INFO.:			JP 2005-113995	200504 11

- AB The polymers, having excellent resistance to peroxide or hydroxyl radicals, have a repeating unit prescribed as that oligomers having continuous four of the unit have lower calculated HOMO than that of control oligomers having continuous four of unit C<sub>6</sub>H<sub>3</sub>(o-SO<sub>3</sub>H)-p-SO<sub>2</sub>C<sub>6</sub>H<sub>3</sub>(m-SO<sub>3</sub>H)-p-C<sub>6</sub>H<sub>4</sub>-p-C<sub>6</sub>H<sub>4</sub>O. Also claimed are polymers having repeating unit C<sub>6</sub>H<sub>3</sub>(o-SO<sub>3</sub>H)-p-SO<sub>2</sub>C<sub>6</sub>H<sub>3</sub>(m-SO<sub>3</sub>H)-p-C<sub>6</sub>H<sub>4</sub>-nAnSO<sub>2</sub>-p-C<sub>6</sub>H<sub>4</sub>-mBmO (A, B = substituent; m, n = 0-4). Further claimed is a method for selecting high-durability polymers as that having lower HOMO than those of other candidates.
- IT 751480-76-9P 753421-07-7P 912548-38-0P  
 912548-40-4P 912548-43-7P 912548-45-9P  
 RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (proton-conductive sulfonated polyethersulfones having high resistance against radical attack for fuel cell electrolytes)
- RN 751480-76-9 HCAPLUS
- CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)] (CA INDEX NAME)



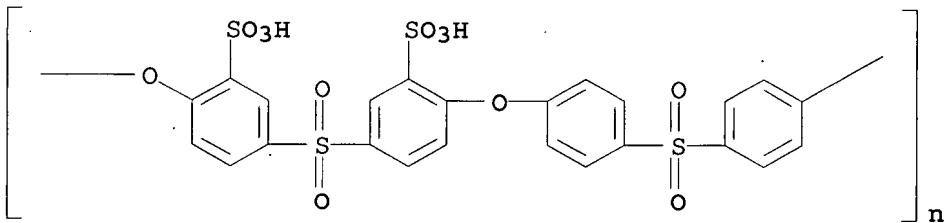
RN 753421-07-7 HCPLUS

CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxygen-1,4-phenylene(1-methylethylidene)-1,4-phenylene] (9CI) (CA INDEX NAME)



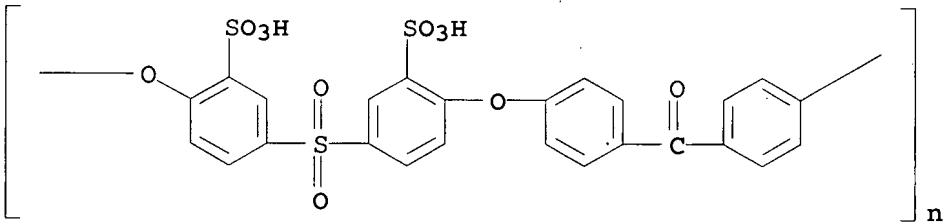
RN 912548-38-0 HCPLUS

CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxygen-1,4-phenylenesulfonyl-1,4-phenylene] (9CI) (CA INDEX NAME)



RN 912548-40-4 HCPLUS

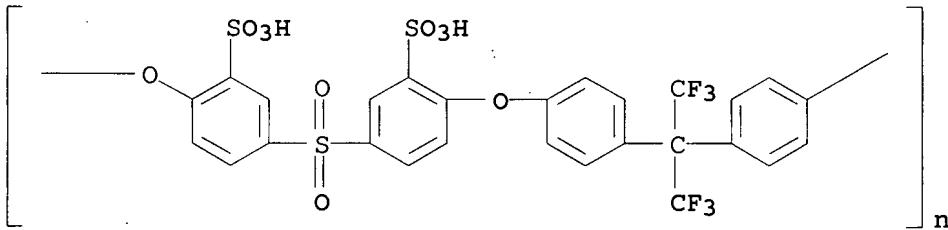
CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxygen-1,4-phenylenecarbonyl-1,4-phenylene] (9CI) (CA INDEX NAME)



RN 912548-43-7 HCPLUS

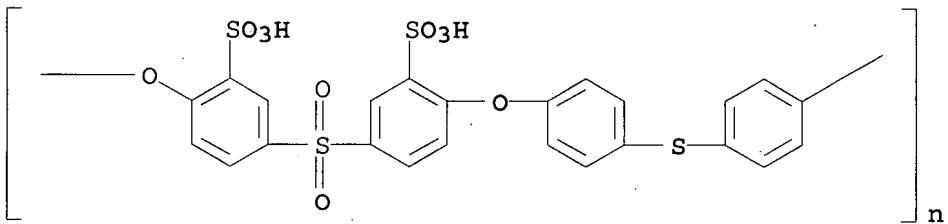
CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxygen-1,4-phenylene[2,2,2-trifluoro-1-(trifluoromethyl)ethylidene]-1,4-

phenylene] (9CI) (CA INDEX NAME)



RN 912548-45-9 HCPLUS

CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy-1,4-phenylenethio-1,4-phenylene] (CA INDEX NAME)



CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s) : 38

IT 751480-76-9P 753421-07-7P 912548-38-0P  
912548-40-4P 912548-43-7P 912548-45-9P

RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(proton-conductive sulfonated polyethersulfones having high resistance against radical attack for fuel cell electrolytes)

L19 ANSWER 7 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2006:887301 HCPLUS

DOCUMENT NUMBER: 146:482319

TITLE: Synthesis of multiblock copolymers based on sulfonated segmented hydrophilic-hydrophobic blocks for proton exchange membranes

AUTHOR(S): Lee, Hae-Seung; Roy, Abhishek; Badami, Anand S.; McGrath, James E.

CORPORATE SOURCE: Macromolecules and Interfaces Institute, Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA

SOURCE: PMSE Preprints (2006), 95, 210-211  
CODEN: PPMRA9; ISSN: 1550-6703

PUBLISHER: American Chemical Society

DOCUMENT TYPE: Journal; (computer optical disk)

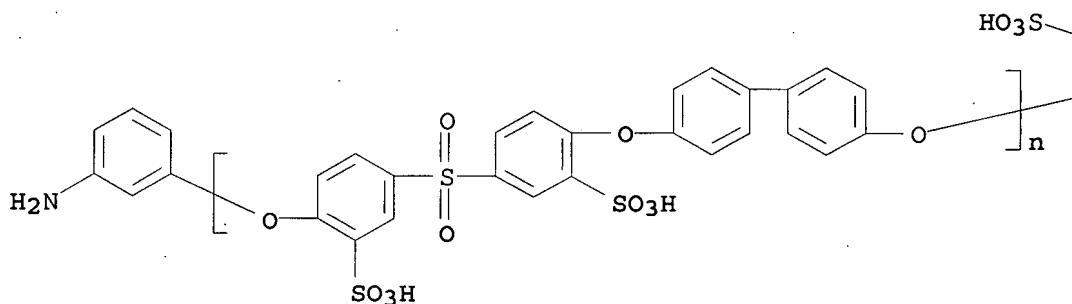
LANGUAGE: English

AB Controlled mol. weight hydrophilic and hydrophobic blocks with primary amine and anhydride end groups were successfully synthesized. A series of segmented sulfonated poly(arylene ether)-B-polyimide multiblock copolymers having various block lengths were synthesized via coupling reaction between amine moieties on hydrophilic blocks

and anhydride moieties on hydrophobic blocks. Successful imidization reactions require an NMP + m-cresol mixed solvent system and catalysis was essential. All copolymers give tough, ductile films when cast with a NMP solution. Several membrane parameters were investigated e.g. water uptake, proton conductivity, and methanol permeability. The new materials are strong candidates for PEM systems.

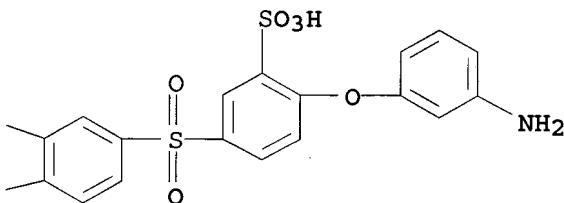
- IT 936028-30-7DP, potassium exchanged  
 RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation);  
 RACT (Reactant or reagent)  
 (synthesis of multiblock copolymers based on sulfonated segmented hydrophilic-hydrophobic blocks for proton exchange membranes)
- RN 936028-30-7 HCAPLUS
- CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy sodium salt (1:2)],  $\alpha$ -[4-[[4-(3-aminophenoxy)-3-sulfophenyl]sulfonyl]-2-sulfophenyl]- $\omega$ -(3-aminophenyl)-, sodium salt (1:2) (CA INDEX NAME)

PAGE 1-A



● 4 Na

PAGE 1-B



- CC 35-5 (Chemistry of Synthetic High Polymers)  
 IT 389600-31-1DP, aminophenyl-terminated, potassium-exchanged  
 936028-30-7DP, potassium exchanged 936028-31-8P  
 936028-33-0P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation);  
RACT (Reactant or reagent)

(synthesis of multiblock copolymers based on sulfonated segmented hydrophilic-hydrophobic blocks for proton exchange membranes)

REFERENCE COUNT: 9 THERE ARE 9 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L19 ANSWER 8 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2006:652947 HCAPLUS

DOCUMENT NUMBER: 145:127532

TITLE: Sulfo-containing polyether segmented block copolymers, their compositions and forms, and fuel cells with proton-exchange membranes comprising same polymers

INVENTOR(S): Kitamura, Kota; Sakaguchi, Yoshimitsu

PATENT ASSIGNEE(S): Toyobo Co., Ltd., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 37 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

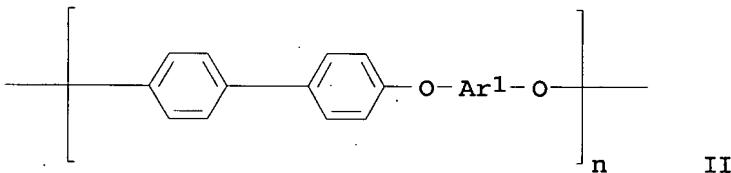
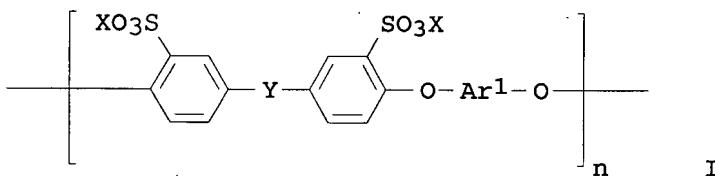
LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2006176666	A	20060706	JP 2004-371769	200412 22
PRIORITY APPLN. INFO.:			JP 2004-371769	200412 22

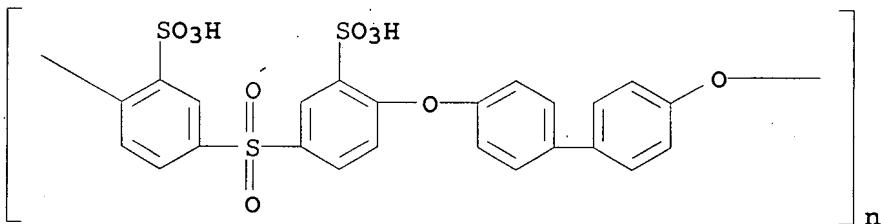
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AB The block copolymers are mainly constituted by (A) sulfo-bearing polyether first segments expressed by the formula I (X = H,

monovalent cation; Y = sulfonyl, carbonyl; Ar1 = divalent aromatic group; n = 3-50), and (B) polyether second segments expressed by II (Ar2 = divalent aromatic group bearing electron-withdrawing groups; m = 3-50). Proton-exchange membranes containing the polymers show high stability in high-temperature (at apprx.200°) high-moist environment, and high H<sup>+</sup> conductivity

- IT 701915-80-2P, 3,3'-Disulfo-4,4'-dichlorodiphenylsulfone disodium salt-4,4'-bisphenol copolymer, sru  
RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(preparation and reaction of; sulfo-containing polyether segmented block copolymers for fuel cell proton-exchange membrane electrolytes)
- RN 701915-80-2 HCAPLUS
- CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene) sodium salt (1:2)] (CA INDEX NAME)



●2 Na

- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 38
- IT 25608-64-4P, 4,4'-Biphenol-4,4'-Dichlorodiphenylsulfone copolymer  
25839-81-0P, 4,4'-Biphenol-4,4'-Dichlorodiphenylsulfone copolymer,  
sru 389600-31-1P, 3,3'-Disulfo-4,4'-dichlorodiphenylsulfone  
disodium salt-4,4'-bisphenol copolymer 701915-80-2P,  
3,3'-Disulfo-4,4'-dichlorodiphenylsulfone disodium  
salt-4,4'-bisphenol copolymer, sru  
RL: IMF (Industrial manufacture); RCT (Reactant); PREP  
(Preparation); RACT (Reactant or reagent)  
(preparation and reaction of; sulfo-containing polyether segmented block copolymers for fuel cell proton-exchange membrane electrolytes)

L19 ANSWER 9 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN  
ACCESSION NUMBER: 2006:529658 HCAPLUS  
DOCUMENT NUMBER: 145:214193  
TITLE: Multiblock sulfonated-fluorinated poly(arylene ether)s for a proton exchange membrane fuel cell  
AUTHOR(S): Ghassemi, Hossein; McGrath, James E.; Zawodzinski, Thomas A.  
CORPORATE SOURCE: Department of Chemical Engineering, Case Western Reserve University, Cleveland, OH, 44106, USA  
SOURCE: Polymer (2006), 47(11), 4132-4139  
CODEN: POLMAG; ISSN: 0032-3861  
PUBLISHER: Elsevier Ltd.  
DOCUMENT TYPE: Journal  
LANGUAGE: English  
AB New p exchange membranes were prepared and evaluated as polymer

electrolytes for a p exchange membrane fuel cell. Sulfonated-fluorinated poly(arylene ether) multiblocks (MBs) were synthesized by nucleophilic aromatic substitution of highly activated F-terminated telechelics made from decafluorobiphenyl with 4,4'-(hexafluoroisopropylidene)diphenol and hydroxyl-terminated telechelics made from 4,4'-biphenol and 3,3'-disulfonated-4,4'-dichlorodiphenylsulfone. Membranes with various sulfonation levels were cast from N-methyl-2-pyrrolidinone. An increase sulfonated block size in the copolymer resulted in enhanced membrane ion exchange capacity and p conductivity. The morphol. structure of MB copolymers was studied by tapping mode AFM and compared with those of Nafion and sulfonated poly(arylene ether) random copolymers. AFM images of MBs revealed well-defined phase separation which may explain their higher p conductivities compared to the random copolymers. The results are of interest for H<sub>2</sub>/air fuel cells where conductivity at high temperature and low relative humidity is a critical issue.

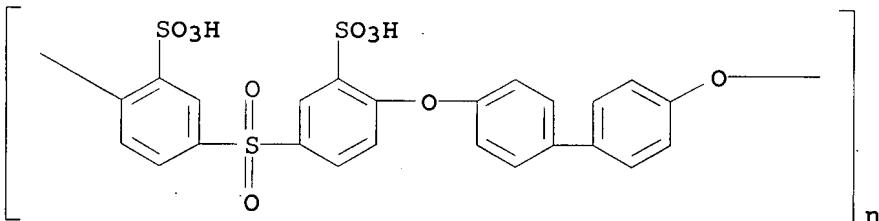
IT 701915-80-2P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation);  
RACT (Reactant or reagent)

(in synthesis of multiblock sulfonated-fluorinated poly(arylene ether)s for proton exchange membrane fuel cells)

RN 701915-80-2 HCAPLUS

CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene) sodium salt (1:2)] (CA INDEX NAME)



•<sub>2</sub> Na

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 35, 38

IT 136835-79-5P 136835-79-5P 136875-49-5P 701915-80-2P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation);  
RACT (Reactant or reagent)

(in synthesis of multiblock sulfonated-fluorinated poly(arylene ether)s for proton exchange membrane fuel cells)

REFERENCE COUNT: 21 THERE ARE 21 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L19 ANSWER 10 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2006:301633 HCAPLUS

DOCUMENT NUMBER: 144:334262

**TITLE:** Electrolyte composition, solid electrolyte membrane and solid polymer fuel cell

INVENTOR(S) : Yoshino, Makoto; Cooray, Nawalage Florence;  
Takei, Fumio

PATENT ASSIGNEE(S) : Fujitsu Limited, Japan

SOURCE: U.S. Pat. Appl. Publ., 8 pp.  
 CODEN: USXXCO  
 DOCUMENT TYPE: Patent  
 LANGUAGE: English  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 2006068254	A1	20060330	US 2005-145213	200506 06
JP 2006100058	A	20060413	JP 2004-283223	200409 29
PRIORITY APPLN. INFO.:			JP 2004-283223	A 200409 29

AB A novel electrolyte composition is provided for obtaining a solid electrolyte membrane capable of exhibiting a large ion exchange capacity, high proton conductivity and a low methanol permeation coefficient. This electrolyte composition contains a sulfonic acid group-containing polyimide and having a specific structure. Such a polyimide can be obtained, for example, by reacting 1,4,5,8-naphthalenetetracarboxylic dianhydride with a diamine compound

**880872-94-6P**

RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)  
 (electrolyte composition, solid electrolyte membrane and solid polymer fuel cell)

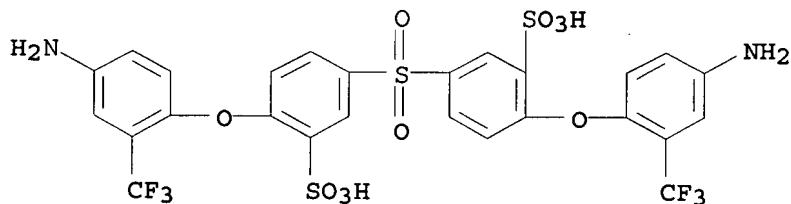
RN 880872-94-6 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-[4-amino-2-(trifluoromethyl)phenoxy]-, polymer with [2]benzopyrano[6,5,4-def][2]benzopyran-1,3,6,8-tetrone (9CI) (CA INDEX NAME)

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CRN 880872-93-5

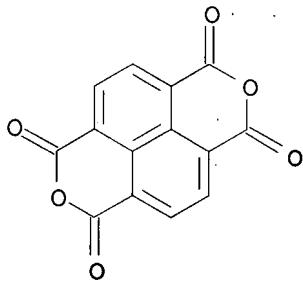
CMF C26 H18 F6 N2 O10 S3



CM 2

CRN 81-30-1

CMF C14 H4 O6



INCL 429033000; 429314000; 429316000; 429317000; 521025000; 521027000;  
427115000  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 38  
IT 880872-94-6P  
RL: DEV (Device component use); PRP (Properties); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)  
(electrolyte composition, solid electrolyte membrane and solid polymer fuel cell)

L19 ANSWER 11 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN  
ACCESSION NUMBER: 2005:844157 HCAPLUS  
DOCUMENT NUMBER: 144:394394  
TITLE: Synthesis and characterization of segmented sulfonated poly(arylene ether)-B-polyimide copolymers as proton exchange membranes  
AUTHOR(S): Lee, Hae-Seung; Einsla, Brian; McGrath, James E.  
CORPORATE SOURCE: Department of Chemistry and Macromolecules and Interfaces Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA  
SOURCE: Preprints of Symposia - American Chemical Society, Division of Fuel Chemistry (2005), 50(2), 579-580  
PUBLISHER: CODEN: PSADFZ; ISSN: 1521-4648  
American Chemical Society, Division of Fuel Chemistry  
DOCUMENT TYPE: Journal; (computer optical disk)  
LANGUAGE: English  
AB Multi phase segmented sulfonated poly(arylene ether)-B-polyimide block copolymer systems may afford higher hydrolytic stability under acidic conditions than similar materials without the polyimide part of the blocks. The polyimide portion of the membrane allows for good mech. properties and low fuel permeability and the sulfonated poly(arylene ether) permits the transport of protons by specific water transport mechanism. This paper describes the synthesis and properties of the polyarylene ether polysulfone blocks which will eventually be included into sulfonated polynaphthalenediimide copolymers with controlled mol. weight. The mol. wts. and intrinsic viscosity were measured for 4 copolymers. Methanol permeability and proton conductivity of several polyimide-polysulfone-polyether polymers and some Nafion membranes were also measured.  
IT 676474-37-6  
RL: PRP (Properties); TEM (Technical or engineered material use);  
USES (Uses)  
(BAPS structures; synthesis and characterization of controlled mol. weight segments of sulfonated poly(arylene ether)-polyimide

block copolymers as proton exchange membranes)

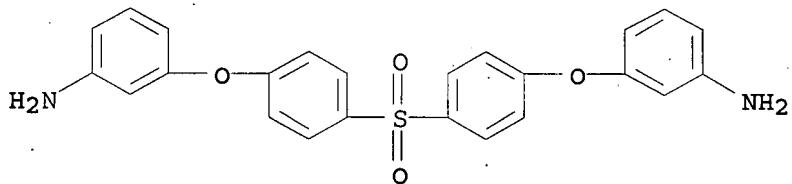
RN 676474-37-6 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(3-aminophenoxy)-, compd. with N,N-diethylethanamine (1:2), polymer with [2]benzopyrano[6,5,4-def] [2]benzopyran-1,3,6,8-tetrone and 3,3'-[sulfonylbis(4,1-phenyleneoxy)]bis[benzenamine] (9CI) (CA INDEX NAME)

CM 1

CRN 30203-11-3

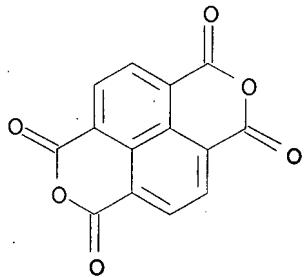
CMF C24 H20 N2 O4 S



CM 2

CRN 81-30-1

CMF C14 H4 O6



CM 3

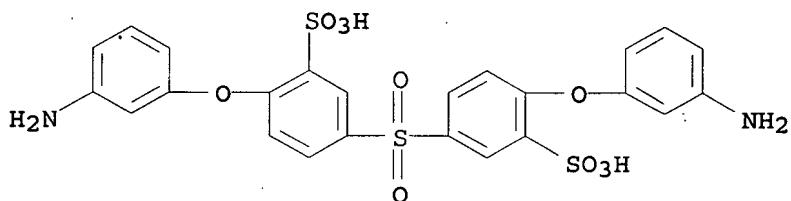
CRN 676474-36-5

CMF C24 H20 N2 O10 S3 . 2 C6 H15 N

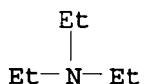
CM 4

CRN 433683-41-1

CMF C24 H20 N2 O10 S3



CM 5

CRN 121-44-8  
CMF C6 H15 N

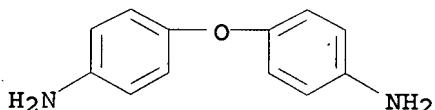
IT 676474-38-7

RL: PRP (Properties); TEM (Technical or engineered material use);  
USES (Uses)(ODA structures; synthesis and characterization of controlled  
mol. weight segments of sulfonated poly(arylene ether)-polyimide  
block copolymers as proton exchange membranes)

RN 676474-38-7 HCAPLUS

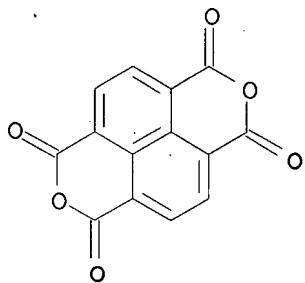
CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(3-aminophenoxy)-, compd.  
with N,N-diethylethanamine (1:2), polymer with [2]benzopyrano[6,5,4-  
def][2]benzopyran-1,3,6,8-tetrone and 4,4'-oxybis[benzeneamine] (9CI)  
(CA INDEX NAME)

CM 1

CRN 101-80-4  
CMF C12 H12 N2 O

CM 2

CRN 81-30-1  
CMF C14 H4 O6



CM 3

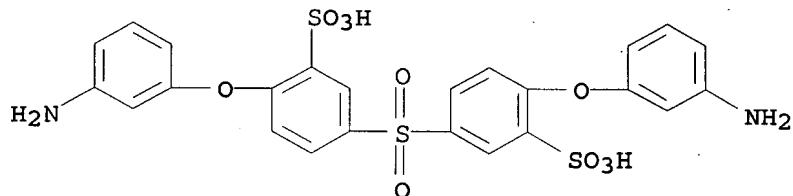
CRN 676474-36-5

CMF C24 H20 N2 O10 S3 . 2 C6 H15 N

CM 4

CRN 433683-41-1

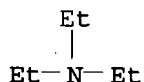
CMF C24 H20 N2 O10 S3



CM 5

CRN 121-44-8

CMF C6 H15 N



CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 35, 36

IT 676474-37-6

RL: PRP (Properties); TEM (Technical or engineered material use);  
 USES (Uses)  
 (BAPS structures; synthesis and characterization of controlled  
 mol. weight segments of sulfonated poly(arylene ether)-polyimide  
 block copolymers as proton exchange membranes)

IT 676474-38-7

RL: PRP (Properties); TEM (Technical or engineered material use);  
 USES (Uses)

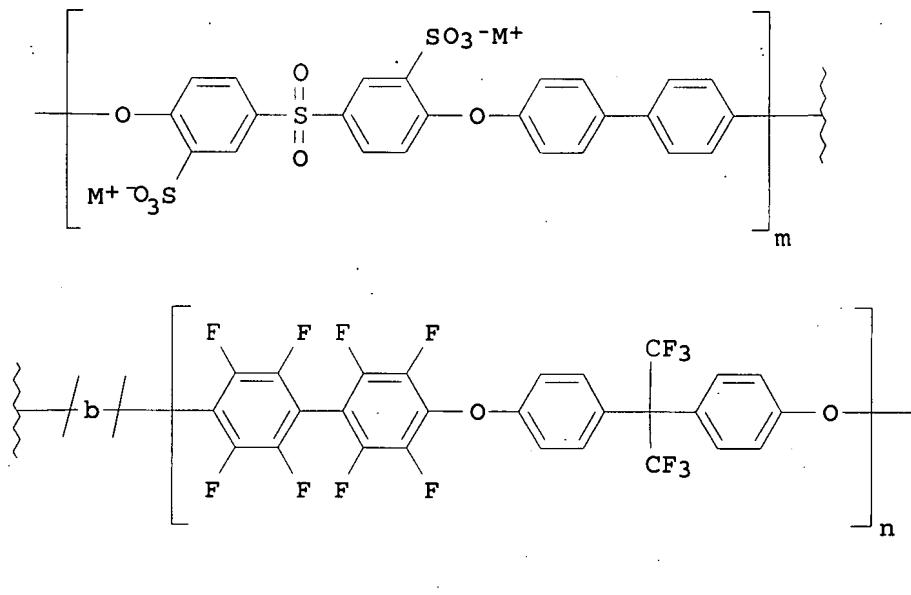
(ODA structures; synthesis and characterization of controlled  
 mol. weight segments of sulfonated poly(arylene ether)-polyimide  
 block copolymers as proton exchange membranes)

REFERENCE COUNT: 8 THERE ARE 8 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L19 ANSWER 12 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2005:493819 HCAPLUS  
 DOCUMENT NUMBER: 143:29508  
 TITLE: Multiblock copolymers containing hydrophilic-hydrophobic segments for proton exchange membrane fuel cells  
 INVENTOR(S): Harrison, William; Ghassemi, Hossein;  
 Zawodzinski, Tom A., Jr.; McGrath, James E.  
 PATENT ASSIGNEE(S): Virginia Tech Intellectual Properties, Inc., USA  
 SOURCE: PCT Int. Appl., 25 pp.  
 CODEN: PIXXD2  
 DOCUMENT TYPE: Patent  
 LANGUAGE: English  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

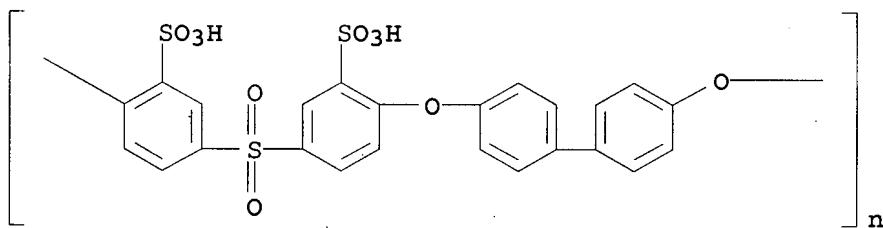
PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2005053060	A2	20050609	WO 2004-US38691	200411 19
WO 2005053060	A3	20051110		
W:	AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW			
RW:	BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG			
CA 2545375	A1	20050609	CA 2004-2545375	200411 19
EP 1687377	A2	20060809	EP 2004-816962	200411 19
R:	AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, FI, RO, CY, TR, BG, CZ, EE, HU, PL, SK, IS			
JP 2007515513	T	20070614	JP 2006-541369	200411 19
PRIORITY APPLN. INFO.:			US 2003-523332P	P 200311 20
			WO 2004-US38691	W 200411 19

GI



I

- AB Novel multiblock copolymers containing perfluorinated poly(arylene ether) as a hydrophobic segment and disulfonated poly(arylene ether sulfone) as a hydrophilic segment are provided. A multiblock copolymer (I) is disclosed, where  $M^+$  is a pos. charged counterion selected from the group consisting of K, Na, and alkyl amine,  $m = 2-50$ ,  $n = 2-30$ , and b represents connection of resp. blocks. The multiblock copolymers are used to form proton exchange membranes that are thermally and hydrolytically stable, flexible, and that exhibit low methanol permeability and high proton conductivity. The proton exchange membranes are thus well-suited for use as polymer electrolytes in fuel cells.
- IT 701915-80-2P  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (multiblock copolymers containing hydrophilic-hydrophobic segments  
 for proton exchange membrane fuel cells)
- RN 701915-80-2 HCPLUS
- CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene) sodium salt (1:2)] (CA INDEX NAME)



## ●2 Na

IC ICM H01M  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 38  
 IT 136835-79-5P 136875-49-5P 701915-79-9P 701915-80-2P  
 RL: SPN (Synthetic preparation); PREP (Preparation)  
 (multiblock copolymers containing hydrophilic-hydrophobic segments  
 for proton exchange membrane fuel cells)

L19 ANSWER 13 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2005:411880 HCPLUS.  
 DOCUMENT NUMBER: 143:117951  
 TITLE: Sulfonated naphthalene dianhydride based  
 polyimide copolymers for proton-exchange-  
 membrane fuel cells. II. Membrane properties and  
 fuel cell performance  
 AUTHOR(S): Einsla, Brian R.; Kim, Yu Seung; Hickner,  
 Michael A.; Hong, Young-Taik; Hill, Melinda L.;  
 Pivovar, Bryan S.; McGrath, James E.  
 CORPORATE SOURCE: Macromolecules and Interfaces Institute,  
 Virginia Polytechnic Institute and State  
 University, Blacksburg, VA, 24061, USA  
 SOURCE: Journal of Membrane Science (2005), 255(1-2),  
 141-148  
 CODEN: JMESDO; ISSN: 0376-7388  
 PUBLISHER: Elsevier B.V.  
 DOCUMENT TYPE: Journal  
 LANGUAGE: English  
 AB Selected properties of two series of sulfonated naphthalene  
 dianhydride based polyimide copolymers were studied to assess their  
 potential for fuel cell applications. The copolyimides were  
 synthesized in m-cresol from a novel disulfonated diamine  
 3,3'-disulfonic acid-bis[4-(3-aminophenoxy)phenyl]sulfone  
 (SA-DADPS), 1,4,5,8-naphthalenetetracarboxylic dianhydride (NDA),  
 and one of two nonsulfonated diamines (4,4'-oxydianiline (ODA) or  
 bis[4-(3-aminophenoxy)phenyl] sulfone (m-BAPS)). Both systems  
 produced tough, ductile cast films. The membrane parameters studied  
 include water sorption, proton conductivity, water stability, methanol  
 permeability and direct methanol fuel cell (DMFC) performance. The  
 mol. structure of the nonsulfonated diamine significantly influenced  
 the hydrolytic stability of the membrane in water at 80°C.  
 However, the water sorption and proton conductivity were primarily a  
 function of the ion exchange capacity (IEC) and were independent of  
 the structure of the nonsulfonated diamine. The copolyimide  
 membranes using m-BAPS as the nonsulfonated diamine displayed the  
 best water stability at 80°. Unfortunately, the best

hydrolytic stability achieved was still much lower than Nafion or analogous poly(arylene ether)s. At relatively high ion exchange capacities, the proton conductivities of the polyimides in water at 30 °C were equivalent to Nafion 1135. An IEC of .apprx.1.9 (BAPS-80, ODA-70) was necessary to provide conductivities close to 0.1 S/cm in water at 30°C. The proton conductivity of the membranes increased at elevated temperature and high relative humidity. The initial DMFC performance of several copolyimides was studied, and these membranes had much lower methanol permeability and performed comparably to Nafion 117 over short-term testing at 80°C.

IT 676474-37-6P

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (BAPS-XX; membrane properties and proton-exchange-membrane fuel cell performance of sulfonated naphthalene dianhydride based polyimide copolymers)

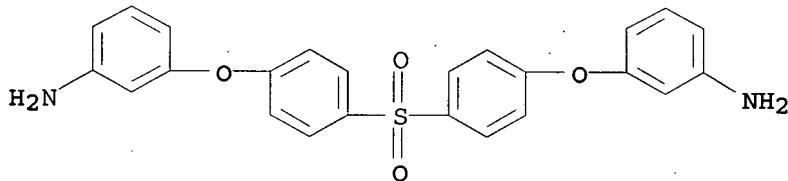
RN 676474-37-6 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(3-aminophenoxy)-, compd. with N,N-diethylethanamine (1:2), polymer with [2]benzopyrano[6,5,4-def] [2]benzopyran-1,3,6,8-tetrone and 3,3'-(sulfonylbis(4,1-phenyleneoxy))bis[benzenamine] (9CI) (CA INDEX NAME)

CM 1

CRN 30203-11-3

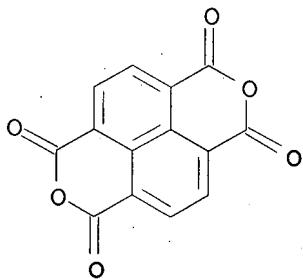
CMF C24 H20 N2 O4 S



CM 2

CRN 81-30-1

CMF C14 H4 O6



CM 3

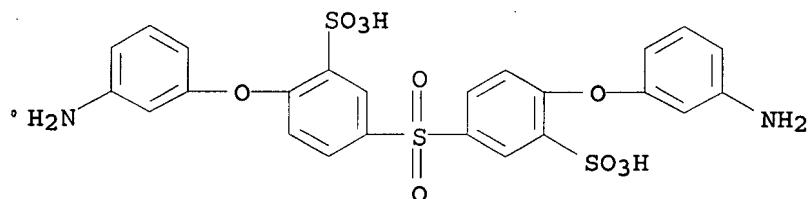
CRN 676474-36-5

CMF C24 H20 N2 O10 S3 . 2 C6 H15 N

CM 4

CRN 433683-41-1

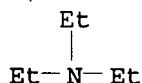
CMF C24 H20 N2 O10 S3



CM 5

CRN 121-44-8

CMF C6 H15 N



IT 676474-38-7P

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (ODA-XX; membrane properties and proton-exchange-membrane fuel cell performance of sulfonated naphthalene dianhydride based polyimide copolymers)

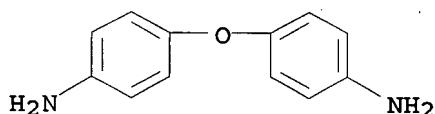
RN 676474-38-7 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(3-aminophenoxy)-, compd. with N,N-diethylethanamine (1:2), polymer with [2]benzopyrano[6,5,4-def][2]benzopyran-1,3,6,8-tetrone and 4,4'-oxybis[benzenamine] (9CI) (CA INDEX NAME)

CM 1

CRN 101-80-4

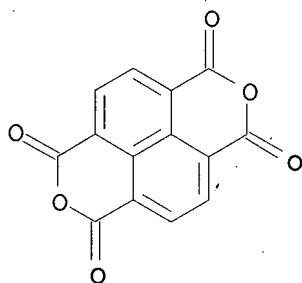
CMF C12 H12 N2 O



CM 2

CRN 81-30-1

CMF C14 H4 O6



CM 3

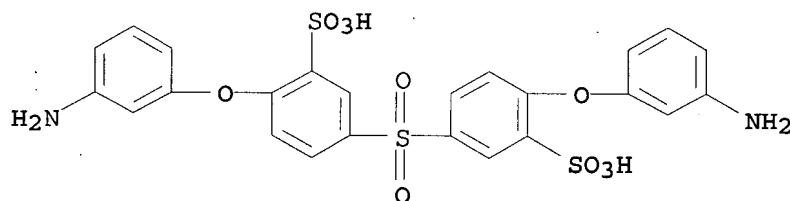
CRN 676474-36-5

CMF C24 H20 N2 O10 S3 . 2 C6 H15 N

CM 4

CRN 433683-41-1

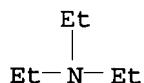
CMF C24 H20 N2 O10 S3



CM 5

CRN 121-44-8

CMF C6 H15 N



CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 36, 38, 76

IT 676474-37-6P

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(BAPS-XX; membrane properties and proton-exchange-membrane fuel cell performance of sulfonated naphthalene dianhydride based polyimide copolymers)

IT 676474-38-7P

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(ODA-XX; membrane properties and proton-exchange-membrane fuel cell performance of sulfonated naphthalene dianhydride based polyimide copolymers)

REFERENCE COUNT: 41 THERE ARE 41 CITED REFERENCES AVAILABLE

FOR THIS RECORD. ALL CITATIONS AVAILABLE  
IN THE RE FORMAT

L19 ANSWER 14 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2004:1128721 HCAPLUS

DOCUMENT NUMBER: 142:77601

TITLE: Proton conductive block-copolymers with good water resistance and low moisture absorption and low methanol penetration for proton conductive membranes

INVENTOR(S): Ishikawa, Junichi; Omi, Katsuhiro; Fujiyama, Akiko; Toriida, Masahiro; Takeda, Koji; Kuroki, Takashi; Tamai, Masashi

PATENT ASSIGNEE(S): Mitsui Chemicals Inc., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 19 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

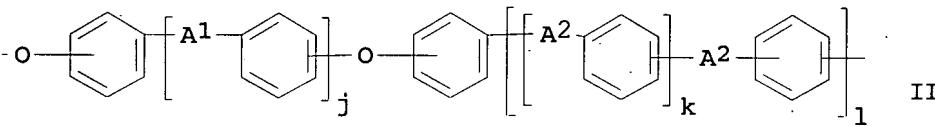
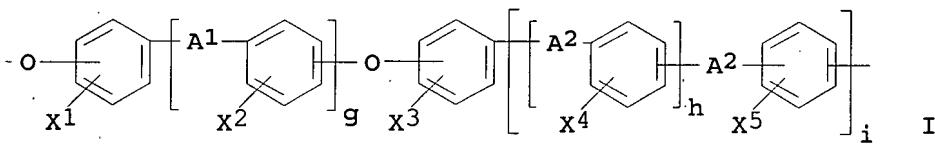
LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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JP 2004359925	A	20041224	JP 2003-207951	200308 19
PRIORITY APPLN. INFO.:			JP 2003-102682	A 200304 07

GI



AB Title block copolymers comprise repeating unit blocks I and II, wherein X1, X2, X3, X4, X5 = H or protonic acid group (at least one of them is a protonic acid group); A1, A2, A3, A4 = direct bond, CH2, C(CH3)2, C(CF3)2, O, SO2, or CO; or g, h, i, j, k, l = 0 or 1; hydrogen of the aromatic ring = H, CmH2m+1, Cl, F, CF3, or CN; and m = 1-10 integer. Thus, 42.23 g 3,3'-carbonylbis(sodium 6-fluorobenzenesulfonate) and 25.63 g bis(3-methyl-4-hydroxyphenyl)methane were reacted at 141° for 8 h to give a copolymer with reduced viscosity 0.13 dL/g and glass transition temperature ≥250°, 21.82 g 4,4'-difluorobenzophenone and

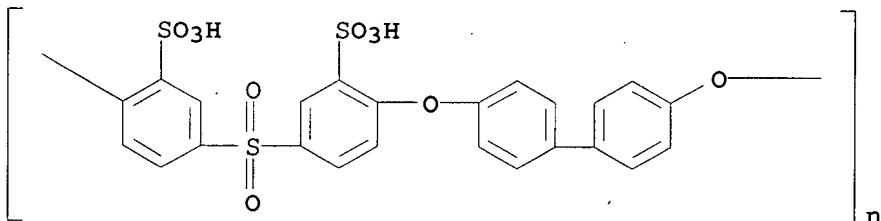
25.63 g bis(3-methyl-4-hydroxyphenyl)methane were added therein and reacted at 157° for 8 h to give a block copolymer with reduced viscosity 1.21 dL/g and glass transition temperature 220°, 4 g of the resulting block copolymer was dissolved in 36 g DMSO/dimethylacetamide mixture, cast onto a glass substrate, dried at 200°, washed, and proton-exchanged with sulfuric acid to give a proton conductive film with ion exchange capacity 510 g/mol, moisture absorption 12%, ion conductivity 0.14 S/cm, and methanol permeability 0.4 μmol/cm<sup>2</sup>·minute.

IT 701915-80-2P

RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)  
(intermediate; preparation of proton conductive block-copolymers with good water resistance, low moisture absorption, and low methanol penetration for proton conductive membranes)

RN 701915-80-2 HCPLUS

CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene) sodium salt (1:2)] (CA INDEX NAME)



●2 Na

IC ICM C08G065-48

ICS C08J005-22; H01M008-02; H01M008-10; C08L071-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 38

IT 389600-31-1P 701915-80-2P 785802-31-5P 812669-30-0P

812669-39-9P 812669-44-6P 812669-47-9P 812669-50-4P

812669-55-9P 812677-79-5P

RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)

(intermediate; preparation of proton conductive block-copolymers with good water resistance, low moisture absorption, and low methanol penetration for proton conductive membranes)

L19 ANSWER 15 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2004:1042268 HCPLUS

DOCUMENT NUMBER: 143:194565

TITLE: Novel proton conducting polyimides from

sulfonated sulfonyl-containing diamine monomer  
Guo, Xiaoxia; Fang, Jianhua; Okamoto, Ken-ichi

SCHOOL OF CHEMISTRY AND CHEMICAL TECHNOLOGY,  
Shanghai Jiao Tong University, Shanghai, 200240,  
Peop. Rep. China

SOURCE: Transactions of the Materials Research Society  
of Japan (2004), 29(6), 2579-2582

CODEN: TMRJE3; ISSN: 1382-3469

PUBLISHER: Materials Research Society of Japan  
 DOCUMENT TYPE: Journal  
 LANGUAGE: English

AB A novel sulfonated diamine monomer, 4,4'-bis(4-aminophenoxy)diphenyl sulfone-3,3'-disulfonic acid (BAPPSDS), was synthesized via two-step reactions. A series of sulfonated (co)polyimides with controlled sulfonation degrees were prepared from NTDA, BAPPSDS, and common nonsulfonated diamines. The homopolyimide NTDA-BAPPSDS was insol. in common organic solvents, whereas the copolyimides could be dissolved in m-cresol and dimethylsulfoxide (DMSO) when a proper nonsulfonated diamine was used. Water uptakes, proton conductivities, water stability and methanol permeability of these copolyimide membranes were investigated and compared with those of other sulfonated diamine-based ones. Polyimide membranes with good proton conductivity as well as good water stability were developed.

IT 500907-46-0P 861882-57-7P 861882-58-8P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (preparation and characterization of proton-conducting polyimides from sulfonated sulfonyl-containing diamine monomers and their membrane performance)

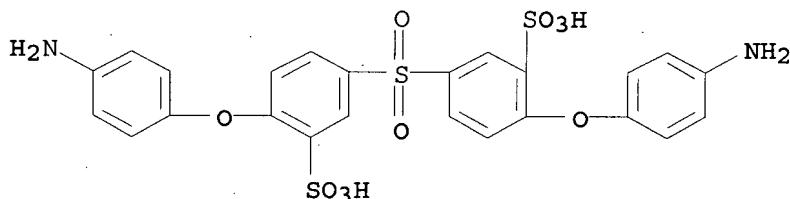
RN 500907-46-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(4-aminophenoxy)-, polymer with [2]benzopyrano[6,5,4-def] [2]benzopyran-1,3,6,8-tetron and 3,3'-dimethyl[1,1'-biphenyl]-4,4'-diamine (9CI) (CA INDEX NAME)

CM 1

CRN 500295-70-5

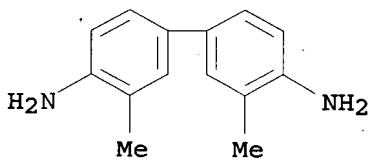
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CM 2

CRN 119-93-7

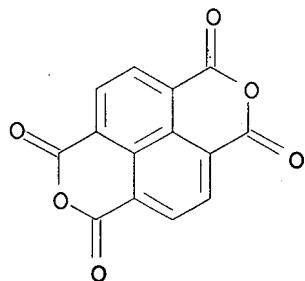
CMF C14 H16 N2



CM 3

CRN 81-30-1

CMF C14 H4 O6



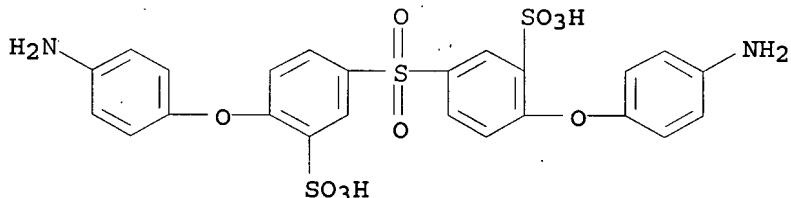
RN 861882-57-7 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(4-aminophenoxy)-, polymer with [2]benzopyrano[6,5,4-def] [2]benzopyran-1,3,6,8-tetrone and 3,3'-(sulfonylbis(4,1-phenyleneoxy)]bis[benzenamine] (9CI) (CA INDEX NAME)

CM 1

CRN 500295-70-5

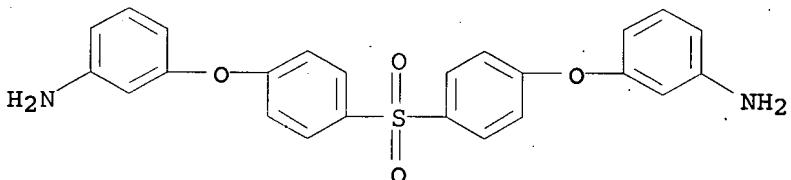
CMF C24 H20 N2 O10 S3



CM 2

CRN 30203-11-3

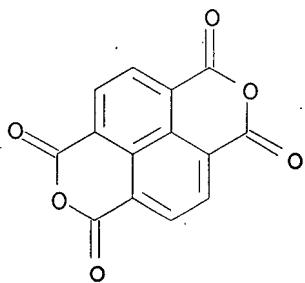
CMF C24 H20 N2 O4 S



CM 3

CRN 81-30-1

CMF C14 H4 O6



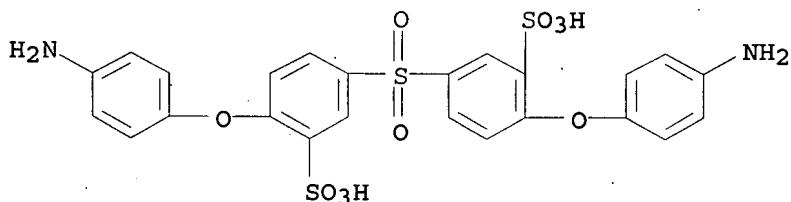
RN 861882-58-8 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(4-aminophenoxy)-, polymer with [2]benzopyrano[6,5,4-def][2]benzopyran-1,3,6,8-tetrone and 4,4'-(1-methylethylidene)bis(4,1-phenyleneoxy)]bis[benzenamine] (9CI) (CA INDEX NAME)

CM 1

CRN 500295-70-5

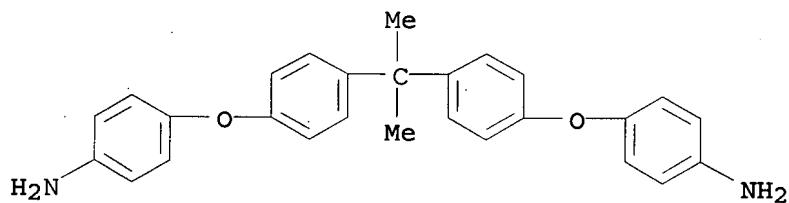
CMF C24 H20 N2 O10 S3



CM 2

CRN 13080-86-9

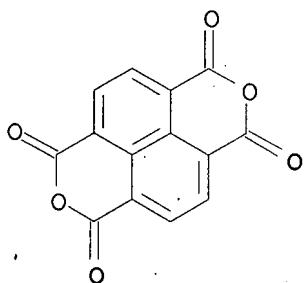
CMF C27 H26 N2 O2



CM 3

CRN 81-30-1

CMF C14 H4 O6

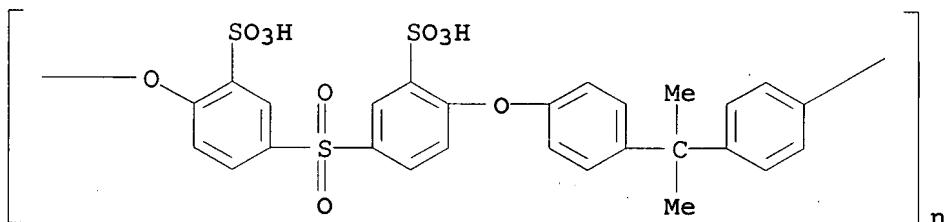


CC 37-3 (Plastics Manufacture and Processing)  
 Section cross-reference(s): 38  
 IT 500907-46-0P 861882-57-7P 861882-58-8P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (preparation and characterization of proton-conducting polyimides from  
 sulfonated sulfonyl-containing diamine monomers and their membrane  
 performance)

REFERENCE COUNT: 14 THERE ARE 14 CITED REFERENCES AVAILABLE  
 FOR THIS RECORD. ALL CITATIONS AVAILABLE  
 IN THE RE FORMAT

L19 ANSWER 16 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2004:921409 HCPLUS  
 DOCUMENT NUMBER: 142:94932  
 TITLE: Acid functionalized poly(arylene ether)s for  
 proton-conducting membranes  
 AUTHOR(S): Shin, Chong Kyu; Maier, Gerhard; Scherer,  
 Guenther G.  
 CORPORATE SOURCE: Lehrstuhl fuer Makromolekulare Stoffe, Institut  
 fuer Technische Chemie, Technische Universitaet  
 Muenchen, Garching, D-85747, Germany  
 SOURCE: Journal of Membrane Science (2004), 245(1-2),  
 163-173  
 CODEN: JMESDO; ISSN: 0376-7388  
 PUBLISHER: Elsevier B.V.  
 DOCUMENT TYPE: Journal  
 LANGUAGE: English  
 AB 4,4'-Difluorobenzophenone and 4,4'-difluoro-diphenylsulfone were  
 sulfonated successfully using fuming sulfuric acid (.apprx.50%  $\text{SO}_3$ ).  
 These monomers and hydroquinone 2-potassium sulfonate were converted  
 to poly(arylene ether)s by nucleophilic displacement  
 polycondensation with different bisphenols in the presence of  
 potassium carbonate in NMP or in DMSO. The polymers obtained by  
 displacement exhibit high molar masses with weight average mol. wts. up to  
 1.84 + 105 g mol<sup>-1</sup> in GPC. The chemical structures of the  
 polymers were confirmed by spectroscopy and elemental anal. The  
 resulting acid functionalized poly(arylene ether)s are amorphous  
 with glass transition temps. between 175 and 248 °C, and the  
 Tg's taken as maximum in the tan δ curve of the DMTA measurements  
 are in good agreement with calorimetry results. The acid  
 functionalized polymers exhibit acceptable thermal stability, i.e.,  
 a 5% weight loss occurred between 310 and 324 °C in TGA under  
 synthetic air. The mech. properties of these polymers indicate  
 ductile mech. behavior with an elongation at break up to 230%.  
 Water uptakes of films cast from the polymers are between 39 and 49%  
 (weight/weight), which corresponds to 8.8-10.0 mols. of  $\text{H}_2\text{O}$  per sulfonic

acid group. Ion exchange capacity was also determined by titration  
 IT 816418-14-1P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (preparation and mech. and thermal properties of acid functionalized  
 poly(arylene ether)s for proton-conducting membranes)  
 RN 816418-14-1 HCPLUS  
 CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy-  
 1,4-phenylene(1-methylethylidene)-1,4-phenylene dipotassium salt]  
 (9CI) (CA INDEX NAME)



## ● 2 K

CC 38-3 (Plastics Fabrication and Uses)  
 IT 25718-32-5P 25897-65-8P 29658-26-2P 31694-16-3P 41205-96-3P  
 60015-06-7P 100344-94-3P 105777-36-4P 109521-12-2P  
 121226-98-0P 123738-57-8P 125490-21-3P 197246-12-1P  
 197246-13-2P 197246-15-4P 197246-16-5P 816418-00-5P  
 816418-06-1P 816418-07-2P 816418-08-3P 816418-09-4P  
 816418-10-7P 816418-11-8P 816418-12-9P 816418-13-0P  
**816418-14-1P** 816431-77-3P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (preparation and mech. and thermal properties of acid functionalized  
 poly(arylene ether)s for proton-conducting membranes)  
 REFERENCE COUNT: 46 THERE ARE 46 CITED REFERENCES AVAILABLE  
 FOR THIS RECORD. ALL CITATIONS AVAILABLE  
 IN THE RE FORMAT

L19 ANSWER 17 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2004:234147 HCPLUS  
 DOCUMENT NUMBER: 141:38957  
 TITLE: New multiblock copolymers containing  
 hydrophilic-hydrophobic segments for proton  
 exchange membrane  
 AUTHOR(S): Ghassemi, Hossein; Harrison, William;  
 Zawodzinski, Tom A., Jr.; McGrath, James E.  
 CORPORATE SOURCE: Department of Chemical Engineering, Case Western  
 Reserve University, Cleveland, OH, 44106, USA  
 SOURCE: Polymer Preprints (American Chemical Society,  
 Division of Polymer Chemistry) (2004), 45(1),  
 68-69  
 CODEN: ACPPAY; ISSN: 0032-3934  
 PUBLISHER: American Chemical Society, Division of Polymer  
 Chemistry  
 DOCUMENT TYPE: Journal; (computer optical disk)  
 LANGUAGE: English

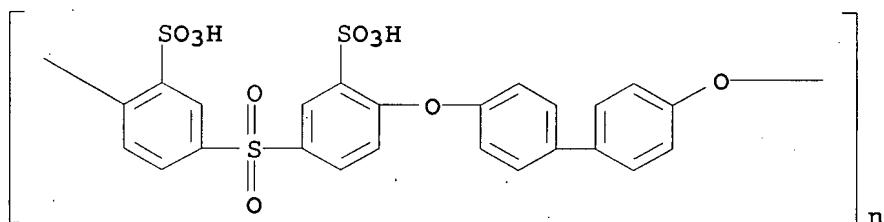
AB The synthesis and characterization of amphiphilic poly(arylene ether) copolymers of disulfonated  $\alpha,w$  hydroxy terminated  $\alpha,\omega$ -fluoro terminated poly(arylene ether sulfone) and  $\alpha,w$  terminated perfluorinated poly(arylene ether) were investigated. The degree of sulfonation of the final segmented polymers was controlled by varying the size of each block, which was measured by end group titration. These multiblock copolymers were investigated by  $^1\text{H-NMR}$  and  $^{19}\text{F-NMR}$  and were further characterized by using DSC and TGA. The copolymers in the salt form were stable up to 500° under a nitrogen or air atmospheric by dynamic TGA. The multiblock copolymers with pendent sulfonic acid groups were soluble in polar solvents such as DMSO and afforded flexible and tough films via casting from solution. The copolymers were somewhat hygroscopic and swelled in water. The proton conductivity values of the copolymers were measured by specific impedance spectroscopy and ranged from 0.1-0.3 S/cm. Further characterization is in progress and will be reported.

IT 701915-80-2P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)  
(multiblock copolymers containing hydrophilic-hydrophobic segments for proton exchange membrane)

RN 701915-80-2 HCPLUS

CN Poly[oxy[1,1'-biphenyl]-4,4'-diyloxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene) sodium salt (1:2)] (CA INDEX NAME)



●2 Na

CC 35-8 (Chemistry of Synthetic High Polymers)

IT 136835-79-5P 136875-49-5P 701915-79-9P 701915-80-2P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)  
(multiblock copolymers containing hydrophilic-hydrophobic segments for proton exchange membrane)

REFERENCE COUNT: 14 THERE ARE 14 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L19 ANSWER 18 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2004:99185 HCPLUS

DOCUMENT NUMBER: 140:304160

TITLE: Sulfonated naphthalene dianhydride based polyimide copolymers for proton-exchange-membrane fuel cells. I. Monomer and copolymer synthesis

AUTHOR(S): Einsla, Brian R.; Hong, Young-Taik; Kim, Yu Seung; Wang, Feng; Gunduz, Nazan; McGrath, James

CORPORATE SOURCE: E.  
 Institute for Polymeric Materials and  
 Interfaces, Virginia Polytechnic Institute and  
 State University, Blacksburg, VA, 24061, USA

SOURCE: Journal of Polymer Science, Part A: Polymer  
 Chemistry (2004), 42(4), 862-874  
 CODEN: JPACEC; ISSN: 0887-624X

PUBLISHER: John Wiley & Sons, Inc.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB A novel sulfonated diamine, 3,3'-disulfonic acid-bis[4-(3-aminophenoxy)-phenyl]sulfone (SA-DADPS), was prepared from m-aminophenol and disodium-3,3'-disulfonate-4,4'-dichlorodiphenylsulfone. The conditions necessary to synthesize and purify SA-DADPS in high yields were investigated in some detail. This disulfonated aromatic diamine, containing ether and sulfone linkages, was used to prepare N-methyl-2-pyrrolidinone-soluble, six-membered ring polyimide copolymers containing pendent sulfonic acid groups by a catalyzed one-step high-temperature polycondensation in m-cresol. These materials showed much improved hydrolytic stability with respect to phthalimides. High-mol.-weight film-forming statistical copolymers with controlled degrees of disulfonation were prepared through variations in the stoichiometric ratio of disulfonated diamine (SA-DADPS) in its soluble triethylamine salt form to several unsulfonated diamines. Three unsulfonated diamines, bis[4-(3-aminophenoxy)-phenyl] sulfone, 4,4'-oxydianiline, and 1,3-phenylenediamine, were used to prepare the copolymers. The characterization of the copolymers by <sup>1</sup>H NMR, Fourier transform IR, ion-exchange capacity, and thermogravimetric anal. demonstrated that SA-DADPS was quant. incorporated into the copolymers. Solution-cast films of the sulfonated copolymers were prepared and afforded tough, ductile membranes with high glass-transition temps. Methods were developed to acidify the triethylammonium salt membranes into their disulfonic acid form, this being necessary for proton conduction in a fuel cell. The synthesis and characterization of these materials are described in this article. Future articles will describe the performance of these copolymers as proton-exchange membranes in hydrogen/air and direct methanol fuel cells.

IT 676474-37-6P 676474-38-7P 676474-39-8P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (preparation of monomers and sulfonated naphthalene dianhydride based polyimide copolymers for proton-exchange-membrane fuel cells)

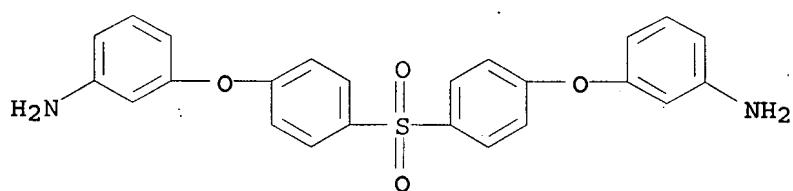
RN 676474-37-6 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(3-aminophenoxy)-, compd. with N,N-diethylethanamine (1:2), polymer with [2]benzopyrano[6,5,4-def][2]benzopyran-1,3,6,8-tetrone and 3,3'-[sulfonylbis(4,1-phenyleneoxy)]bis[benzenamine] (9CI) (CA INDEX NAME)

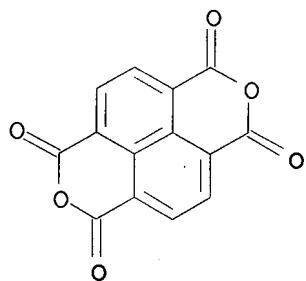
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CRN 30203-11-3

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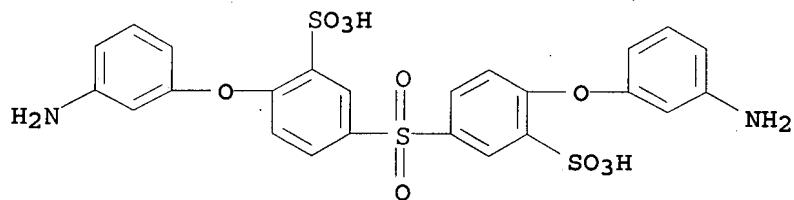
CM 2

CRN 81-30-1  
CMF C14 H4 O6

CM 3

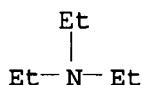
CRN 676474-36-5  
CMF C24 H20 N2 O10 S3 . 2 C6 H15 N

CM 4

CRN 433683-41-1  
CMF C24 H20 N2 O10 S3

CM 5

CRN 121-44-8  
CMF C6 H15 N



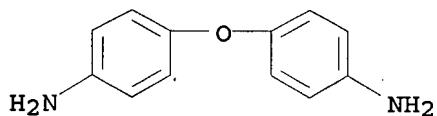
RN 676474-38-7 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(3-aminophenoxy)-, compd.  
with N,N-diethylethanamine (1:2), polymer with [2]benzopyrano[6,5,4-  
def] [2]benzopyran-1,3,6,8-tetrone and 4,4'-oxybis[benzenamine] (9CI)  
(CA INDEX NAME)

CM 1

CRN 101-80-4

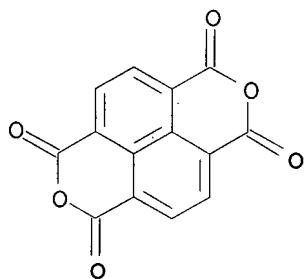
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CM 2

CRN 81-30-1

CMF C14 H4 O6



CM 3

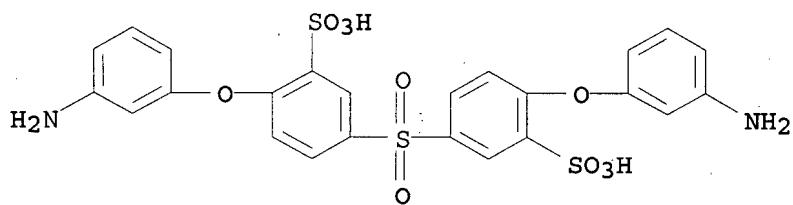
CRN 676474-36-5

CMF C24 H20 N2 O10 S3 . 2 C6 H15 N

CM 4

CRN 433683-41-1

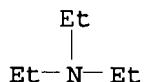
CMF C24 H20 N2 O10 S3



CM 5

CRN 121-44-8

CMF C6 H15 N



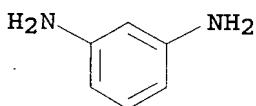
RN 676474-39-8 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(3-aminophenoxy)-, compd. with N,N-diethylethanamine (1:2), polymer with 1,3-benzenediamine and [2]benzopyrano[6,5,4-def] [2]benzopyran-1,3,6,8-tetrone (9CI) (CA INDEX NAME)

CM 1

CRN 108-45-2

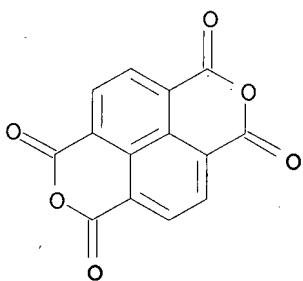
CMF C6 H8 N2



CM 2

CRN 81-30-1

CMF C14 H4 O6

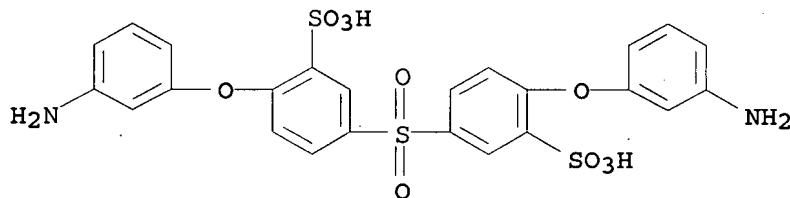


CM 3

CRN 676474-36-5  
 CMF C24 H20 N2 O10 S3 . 2 C6 H15 N

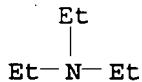
CM 4

CRN 433683-41-1  
 CMF C24 H20 N2 O10 S3



CM 5

CRN 121-44-8  
 CMF C6 H15 N



CC 35-5 (Chemistry of Synthetic High Polymers)  
 Section cross-reference(s): 38  
 IT 27030-66-6P 27057-55-2P 676474-37-6P  
 676474-38-7P 676474-39-8P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (preparation of monomers and sulfonated naphthalene dianhydride based  
 polyimide copolymers for proton-exchange-membrane fuel cells)  
 REFERENCE COUNT: 23 THERE ARE 23 CITED REFERENCES AVAILABLE  
 FOR THIS RECORD. ALL CITATIONS AVAILABLE  
 IN THE RE FORMAT

L19 ANSWER 19 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2003:944625 HCAPLUS  
 DOCUMENT NUMBER: 140:128766  
 TITLE: Synthesis and characterization of poly(arylene  
 ether oxadiazole) telechelics  
 AUTHOR(S): Gomes, Dominique; Nunes, Suzana P.  
 CORPORATE SOURCE: GKSS Research Center, Geesthacht, D-21502,  
 Germany  
 SOURCE: Macromolecular Chemistry and Physics (2003),  
 204(17), 2130-2141  
 CODEN: MCHPES; ISSN: 1022-1352  
 PUBLISHER: Wiley-VCH Verlag GmbH & Co. KGaA  
 DOCUMENT TYPE: Journal  
 LANGUAGE: English  
 AB Poly(arylene ether oxadiazole) telechelics with fluorine and  
 hydroxyl end groups were synthesized by nucleophilic substitution

polymerization of 2,5-bis(4-fluorophenyl)-1,3,4-oxadiazole monomer with bishydroxy compds. containing -CMe<sub>2</sub>, -C(CF<sub>3</sub>)<sub>2</sub> and -SO<sub>2</sub>- groups. Fluoro telechelics were obtained with about 3 repeating units (mol. weight about 2000 g · mol<sup>-1</sup>) using an excess (100 mol %) of bis(fluorophenyl) oxadiazole compound. On the other hand, hydroxy telechelics were synthesized with about 9 repeating units (mol. weight about 5000 g · mol<sup>-1</sup>) using a small excess of bishydroxy compound (monomer molar ratio of 0.93). Sulfonated poly(arylene ether oxadiazole) hydroxy telechelics were also synthesized using sulfonated and unsulfonated bishydroxy compds. All sulfonated hydroxy telechelics were partially water soluble, even when only 40 mol % of sulfonated monomers was used. The number of repeating units of hydroxy telechelics increased up to 12 (mol. weight about 9000 g · mol<sup>-1</sup>) using sulfonated monomers, probably because of the higher reactivity of sulfonated phenoxide. The mol. wts. estimated by <sup>1</sup>H NMR were in agreement with the results obtained by SEC. The telechelics can be used as precursors for the synthesis of block copolymers.

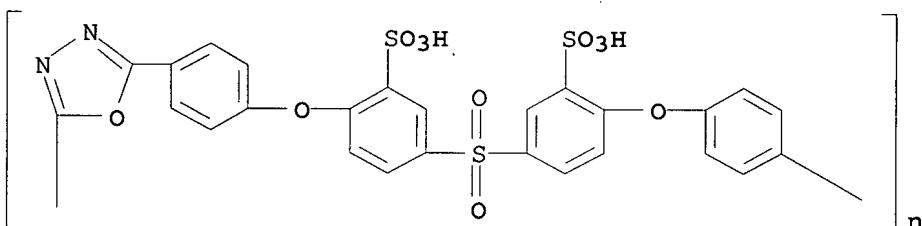
IT 648880-55-1P

RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)

(oligomeric; synthesis and characterization of poly(arylene ether oxadiazole) telechelics)

RN 648880-55-1 HCAPLUS

CN Poly[1,3,4-oxadiazole-2,5-diyl-1,4-phenyleneoxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy-1,4-phenylene disodium salt] (9CI) (CA INDEX NAME)



●2 Na

CC 35-5 (Chemistry of Synthetic High Polymers)

IT 31694-04-9P 133030-02-1P 134436-85-4P, 2,5-Bis(4-fluorophenyl)-1,3,4-oxadiazole-bisphenol AF copolymer, SRU 134438-35-0P, 2,5-Bis(4-fluorophenyl)-1,3,4-oxadiazole-bisphenol A copolymer 134438-36-1P, 2,5-Bis(4-fluorophenyl)-1,3,4-oxadiazole-bisphenol AF copolymer 648880-49-3P, 2,5-Bis(4-fluorophenyl)-1,3,4-oxadiazole-bis(4-hydroxyphenyl) sulfone copolymer 648880-52-8P 648880-53-9P 648880-54-0P 648880-55-1P 648880-56-2P 648880-57-3P

RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)

(oligomeric; synthesis and characterization of poly(arylene ether oxadiazole) telechelics)

REFERENCE COUNT:

23

THERE ARE 23 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L19 ANSWER 20 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2003:319959 HCPLUS  
 DOCUMENT NUMBER: 138:339060  
 TITLE: Crosslinkable aromatic resins having protonic acid groups, and ion conductive polymer membranes, binders, and fuel cells made by using the same  
 INVENTOR(S): Ishikawa, Junichi; Kuroki, Takashi; Fujiyama, Satoko; Omi, Takehiko; Nakata, Tomoyuki; Okawa, Yuichi; Miyazaki, Kazuhisa; Fujii, Shigeharu; Tamai, Shoji  
 PATENT ASSIGNEE(S): Mitsui Chemicals, Inc., Japan  
 SOURCE: PCT Int. Appl., 132 pp.  
 CODEN: PIXXD2  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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WO 2003033566	A1	20030424	WO 2002-JP10536	200210 10
W: CA, CN, IN, JP, KR, US RW: DE, FR, GB, IT, SE				
TW 236486	B	20050721	TW 2002-91123279	200210 09
CA 2463429	A1	20030424	CA 2002-2463429	200210 10
EP 1457511	A1	20040915	EP 2002-775319	200210 10
R: DE, FR, GB, IT, SE, SI, LT, LV, RO, MK, AL CN 1630676	A	20050622	CN 2002-820224	200210 10
US 2004191602	A1	20040930	US 2004-820842	200404 09
PRIORITY APPLN. INFO.:			JP 2001-312799	A 200110 10
			JP 2002-182252	A 200206 21
			WO 2002-JP10536	W 200210 10

AB The invention relates to (A) a crosslinkable aromatic resin which has crosslinking groups and protonic acid groups and is suitable for electrolyte membranes and binders for fuel cells, (B) polymeric electrolyte membranes and binders for fuel cells, made by using the resin, and (C) fuel cells made by using the membranes or the

binders. The aromatic resin has crosslinking groups which are not derived from protonic acid groups and are capable of causing crosslinking without the formation of a leaving component, and exhibits excellent ionic conductivity, heat resistance, water resistance, and adhesion, and low methanol permeability. It is preferable that the aromatic resin bears as the crosslinking groups both C1-10 alkyl bonded directly to an aromatic ring and carbonyl or carbon-carbon double or triple bonds, while preferred examples of the crosslinkable aromatic resin include aromatic polyether, aromatic polyamide, aromatic polyimide, aromatic polyamide-imide, and aromatic polyazole, each of which has crosslinking groups described above. Thus, 5,5'-carbonylbis(sodium 2-fluorobenzenesulfonate) obtained from 0.525 mol 4,4'-difluorobenzophenone and 210 mL 50% sulfuric acid 4.22, 4,4'-difluorobenzophenone 2.18, and 2,2-bis(3,5-dimethyl-4-hydroxyphenyl)propane 5.69 g were reacted at 160° for 4 h in the presence of potassium carbonate to give 10.39 g polyether ketone powder with reduced viscosity 0.85 dL/g, glass transition temperature 230°, and 5% weight loss temperature 367°, which was applied on a glass and dried at 200° for 4 h to give a membrane with conductivity 0.018 S/cm at 30° and 0.065 S/cm at 90°.

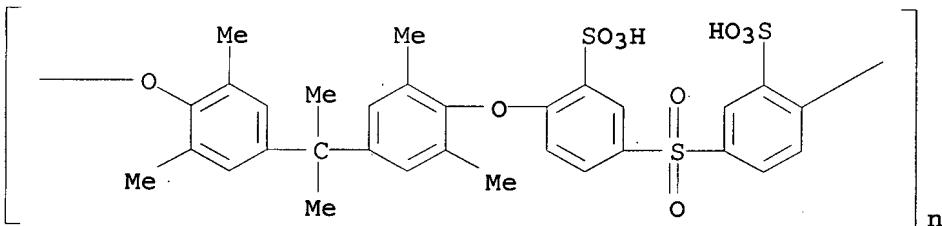
IT 515811-98-0P

RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(preparation of crosslinkable aromatic resins having protonic acid groups for ion conductive polymer membranes, binders, and fuel cells)

RN 515811-98-0 HCPLUS

CN Poly[oxy(2,6-dimethyl-1,4-phenylene)(1-methylethyldene)(3,5-dimethyl-1,4-phenylene)oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene) disodium salt] (9CI) (CA INDEX NAME)



## ●2 Na

IC ICM C08G065-40

ICS C08G069-48; C08G073-10; C08J005-22; H01M008-02

CC 37-3 (Plastics Manufacture and Processing)

Section cross-reference(s): 38, 52

IT 24938-67-8DP, Poly(2,6-dimethyl-1,4-phenylene oxide), sodium sulfonated 267877-35-0DP, reaction products with ethenylphenol  
515144-25-9P 515144-26-0P 515144-27-1P 515144-28-2P

515144-29-3P 515144-30-6P 515144-31-7P 515144-32-8P

515144-33-9P 515144-60-2P 515144-61-3P 515144-62-4P

515144-64-6DP, sulfonated 515144-65-7DP, sulfonated

515811-98-0P

RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(preparation of crosslinkable aromatic resins having protonic acid groups

for ion conductive polymer membranes, binders, and fuel cells)  
 REFERENCE COUNT: 12 THERE ARE 12 CITED REFERENCES AVAILABLE  
 FOR THIS RECORD. ALL CITATIONS AVAILABLE  
 IN THE RE FORMAT

L19 ANSWER 21 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2003:172081 HCAPLUS  
 DOCUMENT NUMBER: 138:224172  
 TITLE: Hydrolysis-resistant polyimide electrolyte  
 membrane for fuel cell  
 INVENTOR(S): Okamoto, Kenichi; Kita, Hidetoshi; Fang,  
 Jian-Hua; Hirano, Tetsuji  
 PATENT ASSIGNEE(S): Yamaguchi T.L.O. Y. K., Japan; Ube Industries,  
 Ltd.  
 SOURCE: Jpn. Kokai Tokkyo Koho, 11 pp.  
 CODEN: JKXXAF  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2003068326	A	20030307	JP 2001-254725	200108 24
JP 3910026	B2	20070425	JP 2001-254725	200108 24
PRIORITY APPLN. INFO.:				

AB Title polyimide electrolyte membrane is characterized in that the polyimide is prepared from diamines including sulfonated aromatic diamine H<sub>2</sub>NA<sub>1</sub>D<sub>1</sub>A<sub>1</sub>NH<sub>2</sub> or H<sub>2</sub>NA<sub>2</sub>D<sub>2</sub>A<sub>3</sub>D<sub>2</sub>A<sub>2</sub>NH<sub>2</sub> [D<sub>1</sub>, D<sub>2</sub> = O, CH<sub>2</sub>, C(CH<sub>3</sub>)<sub>2</sub>, C(CF<sub>3</sub>)<sub>2</sub>, S; A<sub>1</sub> = (C<sub>1</sub>-2 alkyl-substituted) monosulfonated benzene ring; A<sub>2</sub> = (C<sub>1</sub>-2 alkyl-substituted) benzene ring; A<sub>3</sub> = sulfonated aromatic group with certain specific structure].

IT 500907-46-0P  
 RL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (hydrolysis-resistant polyimide electrolyte membrane for fuel cell)

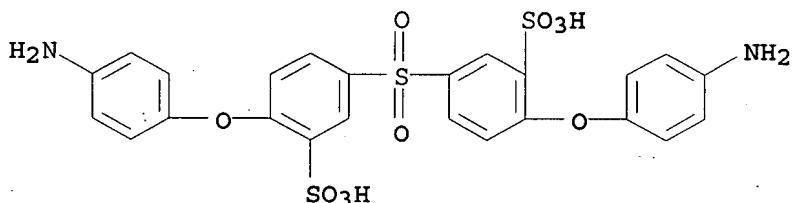
RN 500907-46-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(4-aminophenoxy)-, polymer with [2]benzopyrano[6,5,4-def][2]benzopyran-1,3,6,8-tetrone and 3,3'-dimethyl[1,1'-biphenyl]-4,4'-diamine (9CI) (CA INDEX NAME)

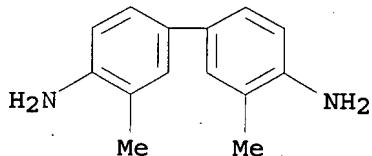
CM 1

CRN 500295-70-5

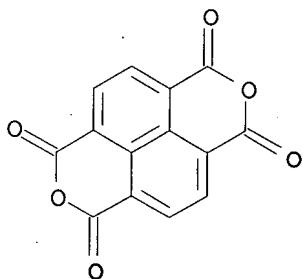
CMF C24 H20 N2 O10 S3



CM 2

CRN 119-93-7  
CMF C14 H16 N2

CM 3

CRN 81-30-1  
CMF C14 H4 O6IC ICM H01M008-02  
ICS H01M008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

IT 444075-08-5P 455944-27-1P 500295-68-1P 500295-69-2P  
500295-73-8P 500295-74-9P 500295-75-0P 500295-76-1P  
500295-77-2P 500907-46-0PRL: IMF (Industrial manufacture); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(hydrolysis-resistant polyimide electrolyte membrane for fuel cell)

L19 ANSWER 22 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2003:168552 HCPLUS

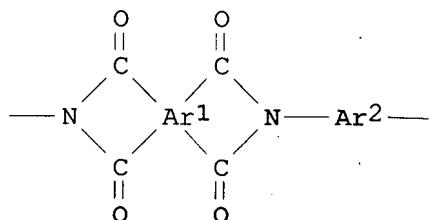
DOCUMENT NUMBER: 138:206141

TITLE: Water-resistant sulfonated aromatic polyimides  
useful for ion-exchange resins

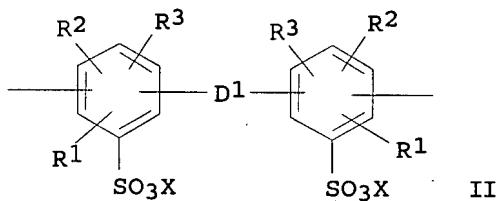
INVENTOR(S): Okamoto, Kenichi; Kita, Hidetoshi; Fang, Chian-hua; Hirano, Tetsuji  
 PATENT ASSIGNEE(S): Yamaguchi T.L.O. Y. K., Japan; Ube Industries, Ltd.  
 SOURCE: Jpn. Kokai Tokkyo Koho, 11 pp.  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2003064181	A	20030305	JP 2001-254724	200108 24
JP 3717157	B2	20051116	JP 2001-254724	200108 24
PRIORITY APPLN. INFO.:				

GI



I



II

AB The sulfonated aromatic polyimides contain structure units represented by the formula I [Ar1 = tetravalent group bearing  $\geq 1$  aromatic ring; Ar2 = II; D1 = O, CH2, CMe2, C(CF3)2, S; R1-R3 = H, C1-2 alkyl, D2Ar5D2; D2 = same as D1' Ar5 = linkage, C6H3SO3X(D6C6H3SO3)n which may be substituted with C1-2 alkyl; X = H, alkali metal; n = 0-2; Ar5 = (alkali metal salts of) naphthalenedisulfonic acid, fluorenedisulfonic acid, and biphenylfluorennetetrasulfonic acid; D6 = direct bond, O, CH2, CMe2, C(CF3)2, SO2, S, CO]. Thus, 10.0 mol 4,4'-bis(4-aminophenoxy)biphenyl-3,3'-disulfonic acid was reacted with 10.0 mol 1,4,5,8-naphthalenetetracarboxylic acid anhydride at 80° for 4 h, followed with 180° for 20 h, in m-cresol in the presence of Et3N, cooled to room temperature, precipitated in acetone, filtered, and dried to give a product with viscosity ( $\eta_{sp}/C$ , in

m-cresol) 10. Its solvent-cast film (sulfonic acid Et<sub>3</sub>N salt-type) was soaked in MeOH then in 1-N HCl for proton exchange, washed with water, and dried to give a film showing no breakage by 180° bending after 250 h in a 80°-water and water absorption 142% after 24 h in a 80°-water.

IT 500295-71-6P 500295-72-7P

RL: IMF (Industrial manufacture); NUU (Other use, unclassified); PREP (Preparation); USES (Uses)

(water-resistant sulfonated aromatic polyimides useful for ion-exchange resins)

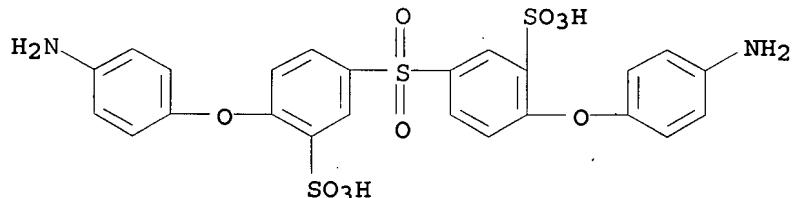
RN 500295-71-6 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(4-aminophenoxy)-, polymer with [2]benzopyrano[6,5,4-def] [2]benzopyran-1,3,6,8-tetrone (9CI) (CA INDEX NAME)

CM 1

CRN 500295-70-5

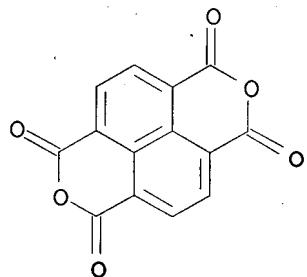
CMF C24 H20 N2 O10 S3



CM 2

CRN 81-30-1

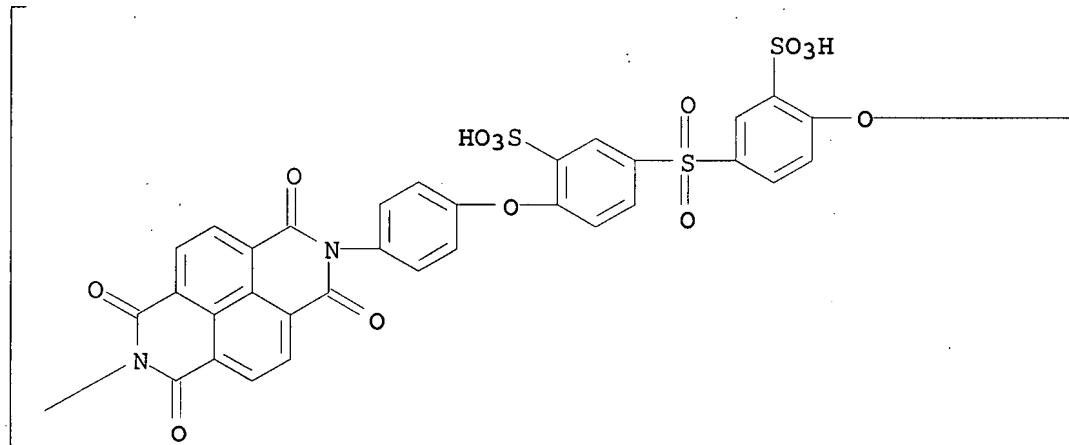
CMF C14 H4 O6



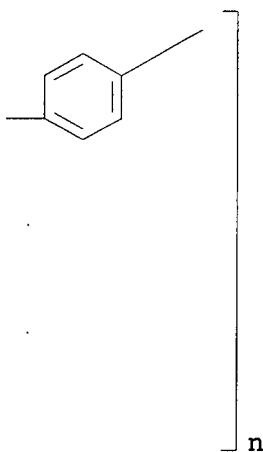
RN 500295-72-7 HCPLUS

CN Poly[(1,3,6,8-tetrahydro-1,3,6,8-tetraoxobenzo[1mn][3,8]phenanthroline-2,7-diyl)-1,4-phenyleneoxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy-1,4-phenylene] (9CI) (CA INDEX NAME)

PAGE 1-A



PAGE 1-B



IC ICM C08G073-10  
 ICS B01J039-18  
 CC 38-3 (Plastics Fabrication and Uses)  
 Section cross-reference(s): 37  
 IT 444075-08-5P 455944-27-1P 500295-68-1P 500295-69-2P  
 500295-71-6P 500295-72-7P 500295-73-8P  
 500295-74-9P 500295-75-0P 500295-76-1P 500295-77-2P  
 RL: IMF (Industrial manufacture); NUU (Other use, unclassified);  
 PREP (Preparation); USES (Uses)  
 (water-resistant sulfonated aromatic polyimides useful for  
 ion-exchange resins)

L19 ANSWER 23 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2002:232044 HCPLUS  
 DOCUMENT NUMBER: 137:6509  
 TITLE: Synthesis and characterization of sulfonated

AUTHOR(S) : polyimides based on six-membered ring as proton exchange membranes

CORPORATE SOURCE: Hong, Young-Taik; Einsla, Brian; Kim, Yuseung; McGrath, James E.

Dep. Chem. Materials Res. Inst., Virginia Polytechnic Inst. State Univ., Blacksburg, VA, 24061, USA

SOURCE: Polymer Preprints (American Chemical Society, Division of Polymer Chemistry) (2002), 43(1), 666-667

CODEN: ACPPAY; ISSN: 0032-3934

PUBLISHER: American Chemical Society, Division of Polymer Chemistry

DOCUMENT TYPE: Journal; (computer optical disk)

LANGUAGE: English

AB Aromatic six-membered ring polyimides containing pendant sulfonic acid groups appear to be promising materials for proton exchange membrane fuel cell applications. 3,3'-Disulfonic acid-bis[4-(3-aminophenoxy)phenyl] sulfone (SA-DADPS) as a sulfonated diamine monomer was prepared by nucleophilic substitution of sodium 3,3'-disulfonate-4,4'-dichlorodiphenyl sulfone (S-DCDPS) with m-aminophenol. A series of copolyimides containing sulfonic acid functional groups were synthesized from six-membered dianhydrides, SA-DADPS and m-BAPS via high-temperature direct polycondensation using m-cresol as a solvent. The copolyimides were characterized for mol. weight, chemical composition, thermal stability, solvent solubility and film forming properties via solution casting from DMAc. The materials are of interest as new polymeric electrolyte proton exchange membranes.

IT 433683-42-2P

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses) (synthesis and characterization of sulfonated polyether-polysulfone-polyimides based on naphthalenetetracarboxylic dianhydride for proton exchange membranes)

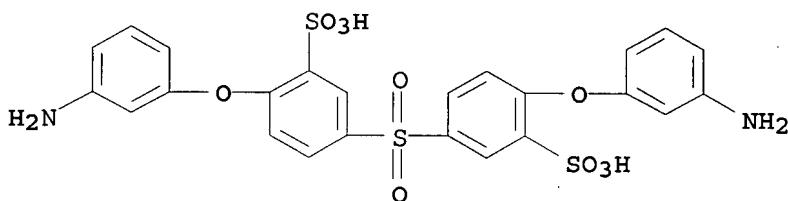
RN 433683-42-2 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-(3-aminophenoxy)-, polymer with [2]benzopyrano[6,5,4-def][2]benzopyran-1,3,6,8-tetrone and 3,3'-(sulfonylbis(4,1-phenyleneoxy))bis[benzenamine] (9CI) (CA INDEX NAME)

CM 1

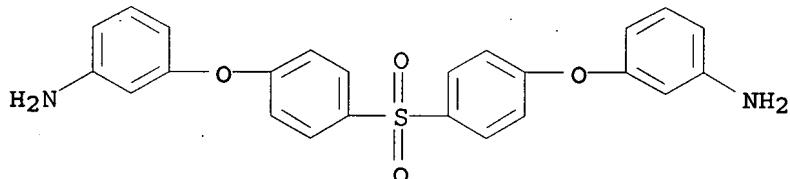
CRN 433683-41-1

CMF C24 H20 N2 O10 S3



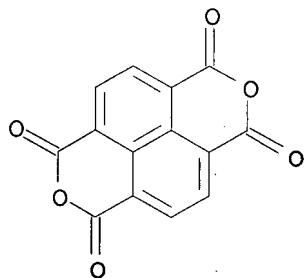
CM 2

CRN 30203-11-3  
 CMF C24 H20 N2 O4 S



CM 3

CRN 81-30-1  
 CMF C14 H4 O6



CC 35-5 (Chemistry of Synthetic High Polymers)  
 IT 433683-42-2P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (synthesis and characterization of sulfonated polyether-polysulfone-polyimides based on naphthalenetetracarboxylic dianhydride for proton exchange membranes)

REFERENCE COUNT: 12 THERE ARE 12 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L19 ANSWER 24 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 1993:148174 HCPLUS  
 DOCUMENT NUMBER: 118:148174  
 TITLE: Synthesis and characterization of aromatic poly(ether sulfone)s containing pendent sodium sulfonate groups  
 AUTHOR(S): Ueda, Mitsuru; Toyota, Hidetsugu; Ouchi, Takao;  
 Sugiyama, Junichi; Yonetake, Koichiro; Masuko, Toru; Teramoto, Takero  
 CORPORATE SOURCE: Fac. Eng., Yamagata Univ., Yonezawa, 992, Japan  
 SOURCE: Journal of Polymer Science, Part A: Polymer Chemistry (1993), 31(4), 853-8  
 CODEN: JPACEC; ISSN: 0887-624X  
 DOCUMENT TYPE: Journal  
 LANGUAGE: English  
 AB Poly(ether sulfones) containing pendent sodium sulfonate groups were

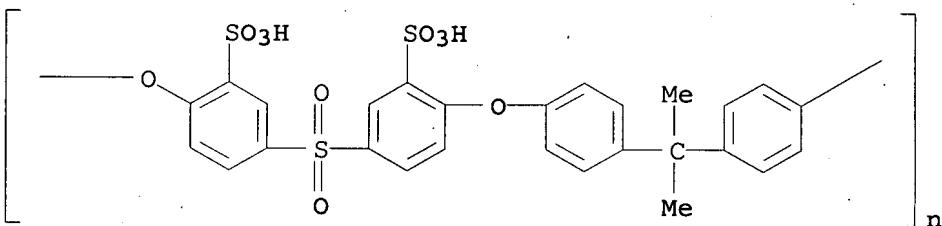
prepared by the aromatic nucleophilic substitution reaction of 4,4'-dichlorodiphenylsulfone (I) and sodium 5,5'-sulfonylbis(2-chlorobenzenesulfonate) (II) with bisphenols in the presence of K<sub>2</sub>CO<sub>3</sub> in N,N-dimethylacetamide. A new monomer containing the sodium sulfonate groups was synthesized by the sulfonation of I with fuming H<sub>2</sub>SO<sub>4</sub>. The polycondensation proceeded smoothly at 170° and produced the desired poly(ether sulfone)s containing the Na sulfonate with inherent viscosities up to 1.2 dL/g. The polymers were quite soluble in strong acid, dipolar aprotic solvents, m-cresol, and dichloromethane. The thermogravimetry of the polymers showed excellent thermal stability, indicating that 10% weight losses of the polymers were observed in the range above 460° in N atmospheric. Both the glass transition temps. and hydrophilicity of the polymers increased with increasing their concns. of Na sulfonate groups.

IT 146673-85-0P

RL: SPN (Synthetic preparation); PREP (Preparation)  
(preparation and thermal and mech. and wetting properties of)

RN 146673-85-0 HCPLUS

CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxy-1,4-phenylene(1-methylethylidene)-1,4-phenylene sodium salt (1:2)]  
(CA INDEX NAME)



## ●2 Na

CC 35-5 (Chemistry of Synthetic High Polymers)  
Section cross-reference(s): 36

IT 146673-85-0P 146673-88-3P 146673-89-4P 146696-52-8P  
RL: SPN (Synthetic preparation); PREP (Preparation)  
(preparation and thermal and mech. and wetting properties of)

L19 ANSWER 25 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1990:21731 HCPLUS

DOCUMENT NUMBER: 112:21731

TITLE: Polyesters with good crystallinity

INVENTOR(S): Oohashi, Toshio; Matsumoto, Tetsuo; Matsunaga, Nobuhiro; Tsujimoto, Keizo; Imamura, Takayuki

PATENT ASSIGNEE(S): Japan Ester Co., Ltd., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 4 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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JP 01095152

A

19890413

JP 1987-252117

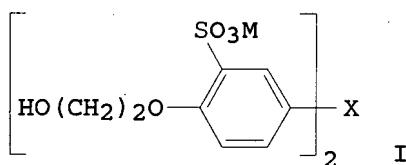
198710  
06

PRIORITY APPLN. INFO.:

JP 1987-252117

198710  
06

GI



**AB** Polyesters with good crystallinity, useful for injection moldings, are prepared by reaction of diols I [X = CR<sub>1</sub>R<sub>2</sub>, O, SO<sub>2</sub>; M = Na, K; R<sub>1</sub>, R<sub>2</sub> = H, lower alkyl; aromatic ring may contain substituent] with poly(alkylene terephthalates) or their blends with other polyesters with. Thus, 1.5:1 M mixture of terephthalic acid and ethylene glycol (II) was treated at 260° for 5 h in bis(β-hydroxy-ethyl) terephthalate and its oligomer, then the product was treated with 0.2 mol% I (X = CMe<sub>2</sub>, M = Na) (III) in II in the presence of Sb<sub>2</sub>O<sub>3</sub> at 280° and 1 Torr to give a polymer showing m.p. 252.0° and crystallization temperature 126.5° on heating and 210.5° on cooling, vs. 258.0, 137.5, and 185.0, resp., without III.

**IT** 124406-98-0P, Bis(4-β-hydroxyethoxy-3-sodiosulfophenyl) sulfone-bis(β-hydroxyethyl) terephthalate-ethylene glycol-terephthalic acid copolymer

RL: PREP (Preparation)

(preparation of, with good crystallinity)

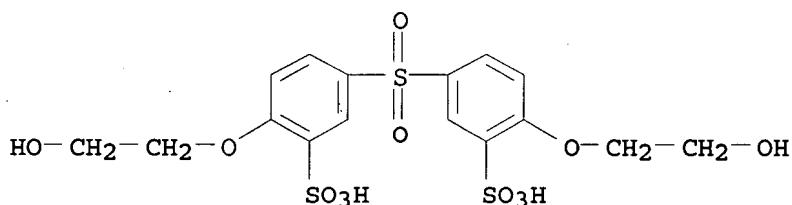
**RN** 124406-98-0 HCPLUS

**CN** 1,4-Benzenedicarboxylic acid, polymer with bis(2-hydroxyethyl) 1,4-benzenedicarboxylate, 1,2-ethanediol and 3,3'-sulfonylbis[6-(2-hydroxyethoxy)benzenesulfonic acid] disodium salt (9CI) (CA INDEX NAME)

**CM** 1

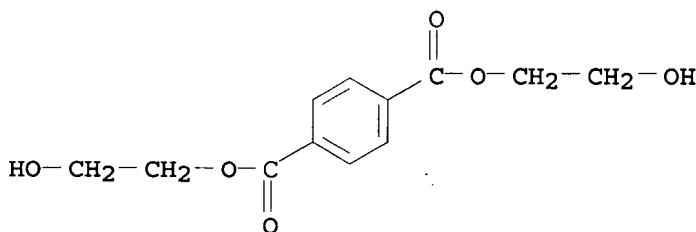
**CRN** 124406-97-9

**CMF** C16 H18 O12 S3 . 2 Na



## ●2 Na

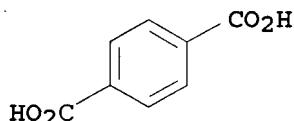
CM 2

CRN 959-26-2  
CMF C12 H14 O6

CM 3

CRN 107-21-1  
CMF C2 H6 O2HO—CH<sub>2</sub>—CH<sub>2</sub>—OH

CM 4

CRN 100-21-0  
CMF C8 H6 O4

IC ICM C08L067-00  
 ICS C08K005-42  
 CC 37-3 (Plastics Manufacture and Processing)  
 Section cross-reference(s): 35

IT 124396-82-3P 124396-84-5P, Bis(4- $\beta$ -hydroxyethoxy-3-sodiosulfophenyl) ether-bis( $\beta$ -hydroxyethyl) terephthalate-ethylene glycol-terephthalic acid copolymer  
 124396-85-6P 124406-98-0P, Bis(4- $\beta$ -hydroxyethoxy-3-sodiosulfophenyl) sulfone-bis( $\beta$ -hydroxyethyl) terephthalate-ethylene glycol-terephthalic acid copolymer  
 RL: PREP (Preparation)  
 (preparation of, with good crystallinity)

L19 ANSWER 26 OF 29 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1984:7729 HCAPLUS  
 DOCUMENT NUMBER: 100:7729  
 TITLE: Hydrophilic resin compositions  
 PATENT ASSIGNEE(S): Unitika Ltd., Japan  
 SOURCE: Jpn. Kokai Tokkyo Koho, 4 pp.  
 CODEN: JKXXAF  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 58084849	A	19830521	JP 1981-182726	198111 13
PRIORITY APPLN. INFO.:			JP 1981-182726	198111 13

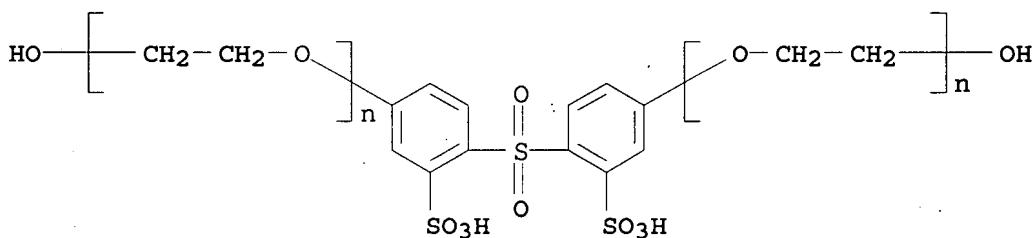
AB The title compns. contain polyesters, polyamides, or polyester-polyamides prepared with sulfonated, alkoxylated bisphenols and other thermoplastics. The compns. have good water absorption and are useful in textile products. Thus, bis(2-hydroxyethyl) terephthalate was copolymerd. with ethoxylated (d.p. 80) 2,2'-disulfobisphenol A to give a block copolymer, 10 parts of which was mixed with 90 parts poly(ethylene terephthalate) and spun to fibers. Fabrics prepared from these fibers had good antistatic properties.

IT 87092-91-9D, polymers with bis(2-hydroxyethyl)terephthalate  
 RL: USES (Uses)

(fibers, antistatic, hydrophilic)

RN 87092-91-9 HCAPLUS

CN Poly(oxy-1,2-ethanediyl),  $\alpha,\alpha'$ -[sulfonylbis(3-sulfo-4,1-phenylene)]bis[ $\omega$ -hydroxy-, disodium salt (9CI) (CA INDEX NAME)

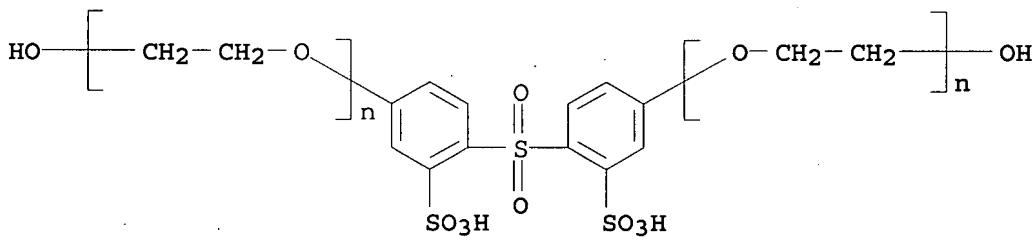


●2 Na

IT 87092-91-9P

RL: PREP (Preparation)  
(preparation of)

RN 87092-91-9 HCPLUS

CN Poly(oxy-1,2-ethanediyl),  $\alpha,\alpha'$ -[sulfonylbis(3-sulfo-4,1-phenylene)]bis[ $\omega$ -hydroxy-, disodium salt (9CI) (CA INDEX NAME)

●2 Na

IC C08L067-00

ICI C08L067-00, C08L077-00

CC 37-3 (Plastics Manufacture and Processing)  
Section cross-reference(s): 40

IT 84749-56-4 87092-91-9D, polymers with bis(2-hydroxyethyl)terephthalate 87092-93-1

RL: USES (Uses)  
(fibers, antistatic, hydrophilic)

IT 84749-55-3P 87092-91-9P 87092-92-0P

RL: PREP (Preparation)  
(preparation of)

L19 ANSWER 27 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1980:42604 HCPLUS

DOCUMENT NUMBER: 92:42604

TITLE: Polysulfones

INVENTOR(S): Gaca, Jerzy; Kozlowski, Kazimierz; Echaust,  
Lucyna; Kucybal, Zdzislaw

PATENT ASSIGNEE(S): Akademia Techniczno-Rolnicza, Bydgoszcz, Pol.

SOURCE: Pol., 2 pp.

CODEN: POXXA7

DOCUMENT TYPE:

Patent

LANGUAGE:

Polish

FAMILY ACC. NUM. COUNT:

1

## PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PL 102339	B1	19790331	PL 1977-197561	197704 21
PRIORITY APPLN. INFO.:			PL 1977-197561	A 197704 21

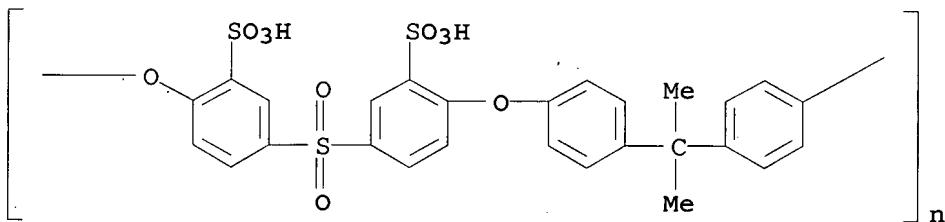
AB Water-soluble polysulfones are prepared by condensation of Na or K salts of 4,4'-sulfonylbis[1-chloro-2-benzenesulfonic acid] (I) with Na or K bisphenolates at 1:1 ratio in aprotic dipolar solvents at 100-200°. Thus, a polysulfone (II) [72355-90-9] was prepared by condensation of Na salt of bisphenol A with Na salt of I at apprx.160° in the presence of NaNH<sub>2</sub> catalyst in DMSO-C<sub>6</sub>H<sub>5</sub>Cl mixture from which water was removed by azeotropic distillation and treatment with CaO. II had mol. weight 17,000-20,000 and it lost 16% of the weight on heating at 700°.

IT 146673-85-0

RL: USES (Uses)  
(heat-resistant)

RN 146673-85-0 HCPLUS

CN Poly[oxy(2-sulfo-1,4-phenylene)sulfonyl(3-sulfo-1,4-phenylene)oxygen-1,4-phenylene(1-methylethylidene)-1,4-phenylene sodium salt (1:2)] (CA INDEX NAME)



●2 Na

IC C08G075-20

CC 35-3 (Synthetic High Polymers)

IT 72355-90-9 146673-85-0

RL: USES (Uses)  
(heat-resistant)

L19 ANSWER 28 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1974:438868 HCPLUS

DOCUMENT NUMBER: 81:38868

TITLE: Ethoxylated benzenesulfonate antistatic agents  
for acrylonitrile polymers

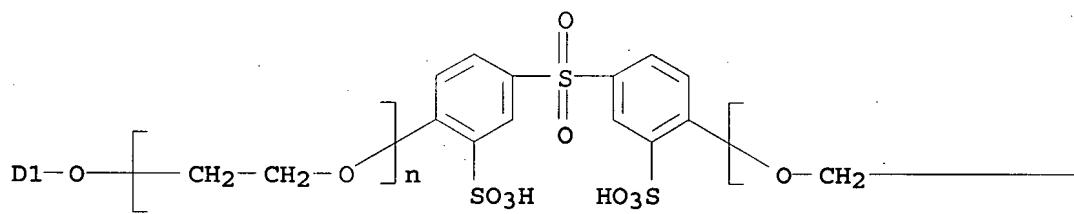
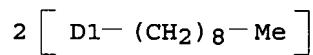
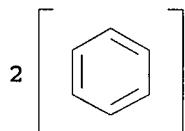
INVENTOR(S): Radlmann, Eduard; Nischk, Guenther E.

PATENT ASSIGNEE(S) : Bayer A.-G.  
 SOURCE: Ger. Offen., 23 pp.  
 CODEN: GWXXBX  
 DOCUMENT TYPE: Patent  
 LANGUAGE: German  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
DE 2217961	A1	19731025	DE 1972-2217961	197204 14
PRIORITY APPLN. INFO.:			DE 1972-2217961	A 197204 14

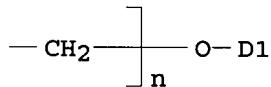
- AB Salts of polyalkylene glycol sulfophenyl ethers are effective antistatic agents for acrylic fibers. Thus, distillation of MeOH from a mixture of 121.4 parts polyethylene glycol monostearyl ether [9005-00-9] (mol. weight 1214) and 5.4 parts NaOMe in 150 parts MeOH, addition of 26.0 parts sodium 4-chloro-3-nitrobenzene sulfonate [17691-19-9], and stirring at 65.deg. to pH 7 gives 100% polyethylene glycol 2-nitro-4-sulfophenyl stearyl ether sodium salt (I) [51433-79-5]. Fibers of 94:5:1 acrylonitrile-methyl acrylate-sodium methallylsulfonate copolymer [26658-88-8] containing 7% I have surface resistance 8 .tim. 1010, 9 .tim. 1010, and 1 .tim. 1011  $\Omega$  after 0, 5, and 10 washings, resp., compared with >1013 in the absence of I.
- IT 51852-83-6  
 RL: USES (Uses)  
 (antistatic agents, for acrylic fibers)
- RN 51852-83-6 HCAPLUS
- CN Poly(oxy-1,2-ethanediyl),  $\alpha,\alpha'$ -[sulfonylbis(2-sulfo-4,1-phenylene)]bis[ $\omega$ -(nonylphenoxy)-, disodium salt (9CI) (CA INDEX NAME)

PAGE 1-A



PAGE 1-B

●2 Na



IC C08G; C08F  
 CC 39-10 (Textiles)  
 IT 51433-79-5 51569-22-3 51852-82-5 51852-83-6  
 51909-21-8  
 RL: USES (Uses)  
 (antistatic agents, for acrylic fibers)

L19 ANSWER 29 OF 29 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1974:122248 HCAPLUS  
 DOCUMENT NUMBER: 80:122248  
 TITLE: Acrylonitrile polymers with antistatic ethoxylated benzenesulfonates  
 INVENTOR(S): Radlmann, Eduard; Nischk, Guenther  
 PATENT ASSIGNEE(S): Farbenfabriken Bayer A.-G.  
 SOURCE: Ger. Offen., 20 pp.  
 CODEN: GWXXBX  
 DOCUMENT TYPE: Patent  
 LANGUAGE: German  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
DE 2217974	A1	19731025	DE 1972-2217974	197204 14
IT 981943	B	19741010	IT 1973-22938	197304 12
GB 1416574	A	19751203	GB 1973-17601	197304 12
CA 1002062	A1	19761221	CA 1973-168547	197304 12
BE 798179	A1	19731015	BE 1973-129978	197304 13
NL 7305221	A	19731016	NL 1973-5221	197304 13
FR 2180103	A1	19731123	FR 1973-13546	197304 13
JP 49018937	A	19740219	JP 1973-41467	197304 13
US 3875127	A	19750401	US 1973-350959	197304 13
ES 413653	A1	19760116	ES 1973-413653	197304 13
PRIORITY APPLN. INFO.:			DE 1972-2217974	A 197204 14

AB Ethoxylated benzenesulfonates (I, R = Me(CH<sub>2</sub>)<sub>17</sub>, H<sub>19</sub>C<sub>9</sub>C<sub>6</sub>H<sub>4</sub>; R<sub>1</sub> = NH<sub>2</sub>, NO<sub>2</sub>, SO<sub>2</sub>; Z = O, NMe; n = 1,2; x = 12-21) and II were prepared and when added to an acrylic polymer spinning solution in DMF gave fibers with washfast, antistatic finishes. Thus, 121.4 parts of a H<sub>2</sub>O free ethoxylated stearyl alc. (mean mol. weight 1214) was treated with 5.4 parts of NaOMe in 150 ml, the MeOH removed at 70.deg., cooled to room temperature, and 4,3-C<sub>1</sub>(O<sub>2</sub>N)C<sub>6</sub>H<sub>3</sub>SO<sub>3</sub>Na was added to the melt in portions keeping the reaction at 65.deg. to give a quant. yield of waxy Na 3-nitro-4-[(stearyloxy)poly(ethyleneoxy)]benzensulfonate (III) [51382-33-3]. A 27% solution of III was added to an acrylic

polymer spinning solution, followed by dry spinning , and stretching to give a fiber containing 7% III. The surface resistance of the untreated fiber was  $>10^{13} \Omega$  while for unwashed, 5 times washed, and 10 washed fiber it was 8 .tim.  $10^{10}$ , 9 .tim.  $10^{10}$ , and 1 .tim.  $10^{11}$ , resp.

IT 52624-78-9

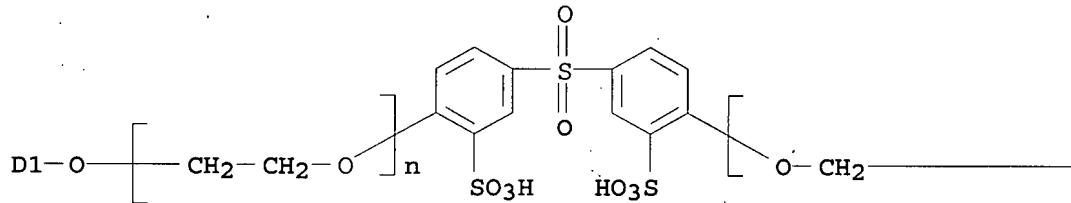
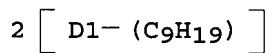
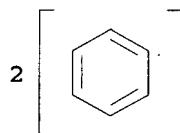
RL: USES (Uses)

(antistatic agent, for acrylic fibers)

RN 52624-78-9 HCAPLUS

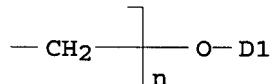
CN Poly(oxy-1,2-ethanediyl),  $\alpha,\alpha'$ -[sulfonylbis(2-sulfo-4,1-phenylene)]bis[ $\omega$ -(isononylphenoxy)-, disodium salt (9CI) (CA INDEX NAME)

PAGE 1-A



PAGE 1-B

● 2 Na



IC D01F; C08F  
 CC 39-2 (Textiles)  
 IT 51569-22-3 51909-21-8 52624-78-9 52642-15-6  
 RL: USES (Uses)  
 (antistatic agent, for acrylic fibers)

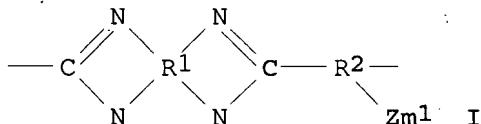
=> d 124 ibib abs hitstr hitind 1-11

L24 ANSWER 1 OF 11 HCPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2005:471208 HCPLUS  
 DOCUMENT NUMBER: 143:8875  
 TITLE: Acidic group-containing polybenzimidazole compositions and their application  
 INVENTOR(S): Sakaguchi, Yoshimitsu; Kitamura, Kota  
 PATENT ASSIGNEE(S): Toyobo Co., Ltd., Japan  
 SOURCE: Jpn. Kokai Tokkyo Koho, 27 pp.  
 CODEN: JKXXAF  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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JP 2005139318	A	20050602	JP 2003-377857	200311 07

PRIORITY APPLN. INFO.: <--  
 JP 2003-377857 200311  
 07

GI



**AB** The compns. contain polybenzimidazoles having structural units I ( $m_1 = 1-4$ ;  $R_1 =$  imidazole ring-forming tetravalent aromatic bonding unit;  $R_2 =$  divalent aromatic bonding unit;  $Z =$  sulfonic acid residue, phosphonic acid residue) and poly(arylene ethers) having structural units of  $C_6H_3(SO_3X)_p-YC_6H_3(SO_3X)_q-OArO$  (both  $SO_3X$  are in  $m$ -position to  $Y$ ;  $Ar =$  divalent aromatic;  $Y = SO_2, CO$ ;  $X = H$ , monovalent cation) and  $C_6H_3(o-CN)OAr'CO$  ( $Ar' =$  divalent aromatic). Ion-conductive membranes containing the compns., their composites with electrodes, fuel cells using the composites and preferably a MeOH fuel, water electrolysis apparatus using the composites, adhesives containing the compns., and manufacture of the ion-conductive membranes by casting step and drying step are also claimed. Thus, a solution containing 2,5-dicarboxybenzenesulfonic acid monosodium salt-3,3',4,4'-tetraaminodiphenylsulfone copolymer and 4,4'-biphenol-2,6-dichlorobenzonitrile-3,3'-disulfo-4,4'-dichlorodiphenylsulfone disodium salt copolymer was cast to give a film, which was processed to give a membrane showing ion conductivity 0.034 S/cm and MeOH permeability 2.97 mmol/m<sup>2</sup>-s.

**IT** 681035-31-4P

RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(polybenzimidazole- and poly(arylene ether)-containing compns. for ion-conductive membranes in fuel cells and water electrolysis apparatus and adhesives)

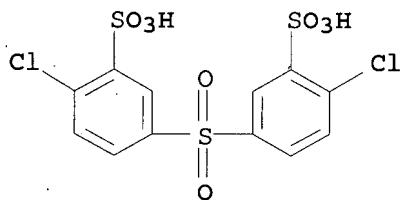
**RN** 681035-31-4 HCPLUS

**CN** Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2), polymer with [1,1'-biphenyl]-4,4'-diol and 2,6-dichlorobenzonitrile (CA INDEX NAME)

**CM** 1

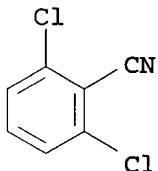
**CRN** 51698-33-0

**CMF** C12 H8 Cl2 O8 S3 . 2 Na

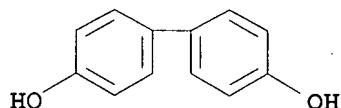


●2 Na

CM 2

CRN 1194-65-6  
CMF C7 H3 Cl2 N

CM 3

CRN 92-88-6  
CMF C12 H10 O2

- IC ICM C08G073-18  
ICS C08G065-34; C08J005-22; C09J171-10; C09J179-04; C25B013-08;  
H01B001-06; H01B013-00; H01M008-02; H01M008-10; C08L079-06
- CC 38-3 (Plastics Fabrication and Uses)  
Section cross-reference(s): 52, 72
- ST fuel cell ion conductive **membrane** polybenzimidazole  
polyoxyarylene; methanol fuel cell ion conductive **membrane**  
; water electrolysis app ion conductive **membrane** electrode  
composite; adhesive acid group polybenzimidazole polyarylene ether;  
dicarboxybenzenesulfonic acid tetraaminodiphenylsulfone copolymer  
ion conductive **membrane**; biphenol dichlorobenzonitrile  
disulfodichlorodiphenylsulfone copolymer ion conductive  
**membrane**
- IT Adhesives  
Electrolytic cells  
Fuel cell electrolytes  
Ion exchange membranes  
Ionic conductors  
(polybenzimidazole- and poly(arylene ether)-containing compns. for  
ion-conductive **membranes** in fuel cells and water  
electrolysis apparatus and adhesives)
- IT Polysulfones, uses  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM  
(Technical or engineered material use); PREP (Preparation); USES  
(Uses)  
(polybenzimidazole-; polybenzimidazole- and poly(arylene  
ether)-containing compns. for ion-conductive **membranes** in  
fuel cells and water electrolysis apparatus and adhesives)
- IT Polysulfones, uses  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM  
(Technical or engineered material use); PREP (Preparation); USES

## (Uses)

(polyoxyarylene-; polybenzimidazole- and poly(arylene ether)-containing compns. for ion-conductive **membranes** in fuel cells and water electrolysis apparatus and adhesives)

IT Polybenzimidazoles

## Polyoxyarylenes

RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(polysulfone-; polybenzimidazole- and poly(arylene ether)-containing compns. for ion-conductive **membranes** in fuel cells and water electrolysis apparatus and adhesives)

IT 67-56-1, Methanol, uses

RL: TEM (Technical or engineered material use); USES (Uses) (fuel in fuel cell; polybenzimidazole- and poly(arylene ether)-containing compns. for ion-conductive **membranes** in fuel cells and water electrolysis apparatus and adhesives)

IT 425636-38-0P, 2,5-Dicarboxybenzenesulfonic acid monosodium salt-3,3',4,4'-tetraaminodiphenylsulfone copolymer 426255-33-6P  
681035-31-4P 852415-23-7P

RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(polybenzimidazole- and poly(arylene ether)-containing compns. for ion-conductive **membranes** in fuel cells and water electrolysis apparatus and adhesives)

L24 ANSWER 2 OF 11 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2005:449863 HCAPLUS

DOCUMENT NUMBER: 142:489515

TITLE: Solid polymer type electrolytic **membrane** superior in gas barrier property, workability, dimensional stability, ion conductivity and liquid permeation inhibition for water electrolysis

INVENTOR(S): Yamashita, Masahiro; Takase, Satoshi; Sakaguchi, Yoshimitsu; Kitamura, Kota

PATENT ASSIGNEE(S): Toyobo Co., Ltd., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 19 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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JP 2005133146	A	20050526	JP 2003-370160	200310 30

PRIORITY APPLN. INFO.: JP 2003-370160

200310  
30

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AB The solid polymer type **ion exchange** **membrane** for water anal. contains polyarylene ether compound and has O<sub>2</sub> permeability of 0.1x10<sup>-12</sup>-3x10<sup>-12</sup> mol/cm.s.

IT 681035-31-4P

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (solid polymer type electrolytic **membrane** superior in  
 gas barrier property, workability, dimensional stability, ion  
 conductivity and liquid permeation inhibition for water electrolysis)

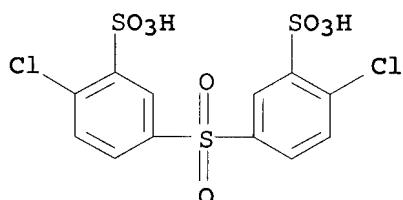
RN 681035-31-4 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2),  
 polymer with [1,1'-biphenyl]-4,4'-diol and 2,6-dichlorobenzonitrile  
 (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

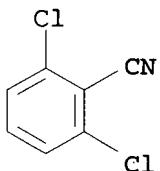


● 2 Na

CM 2

CRN 1194-65-6

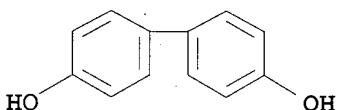
CMF C7 H3 Cl2 N



CM 3

CRN 92-88-6

CMF C12 H10 O2



IC ICM C25B013-08

ICS C08G065-40; C25B009-10; H01B001-06

CC 72-9 (Electrochemistry)

Section cross-reference(s): 38

ST polyarylene ether compd **membrane** water electrolysis

IT Water purification  
 (electrolysis; solid polymer type electrolytic **membrane**  
 superior in gas barrier property, workability, dimensional  
 stability, ion conductivity and liquid permeation inhibition for water  
 electrolysis)

IT **Ion exchange membranes**  
 (solid polymer type electrolytic **membrane** superior in  
 gas barrier property, workability, dimensional stability, ion  
 conductivity and liquid permeation inhibition for water electrolysis)

IT Polyethers, uses  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (solid polymer type electrolytic **membrane** superior in  
 gas barrier property, workability, dimensional stability, ion  
 conductivity and liquid permeation inhibition for water electrolysis)

IT 681035-31-4P 681035-36-9P 681035-37-0P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (solid polymer type electrolytic **membrane** superior in  
 gas barrier property, workability, dimensional stability, ion  
 conductivity and liquid permeation inhibition for water electrolysis)

L24 ANSWER 3 OF 11 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2005:235276 HCPLUS  
 DOCUMENT NUMBER: 142:282889  
 TITLE: **Ion exchange**  
 membrane composite for fuel cell  
 INVENTOR(S): Yamashita, Masahiro; Takase, Satoshi; Takimoto,  
 Naohiko; Nakamura, Muneatsu; Sasai, Kosuke  
 PATENT ASSIGNEE(S): Toyobo Co., Ltd., Japan  
 SOURCE: Jpn. Kokai Tokkyo Koho, 42 pp.  
 CODEN: JKXXAF  
 DOCUMENT TYPE: Patent  
 LANGUAGE: Japanese  
 FAMILY ACC. NUM. COUNT: 1  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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JP 2005068396	A	20050317	JP 2003-410546	200312 09
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PRIORITY APPLN. INFO.:			JP 2003-114628	A 200304 18
<--				
			JP 2003-288193	A 200308 06
<--				

AB The composite has a support **membrane** having continuous  
 open pores for both sides and an **ion exchange**  
 resin infiltrated in the support to satisfy **ion**  
**exchange** resin filling ratio in the pores  $\geq 90\%$ . The  
 composite for an electrolyte **membrane** of a fuel cell has  
 high ion conductivity and prevents liquid fuel permeation.

IT 681035-31-4P

RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(ion exchanger; ion exchange resin-porous membrane support composite for fuel cell electrolyte)

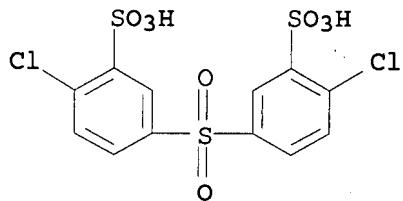
RN 681035-31-4 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2), polymer with [1,1'-biphenyl]-4,4'-diol and 2,6-dichlorobenzonitrile (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

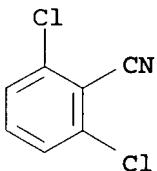


●2 Na

CM 2

CRN 1194-65-6

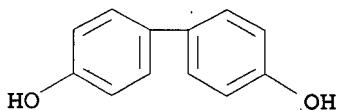
CMF C7 H3 Cl2 N



CM 3

CRN 92-88-6

CMF C12 H10 O2



IC ICM C08J005-22

ICS B01J039-18; B01J047-12; C08G065-40; H01B001-06; H01M008-02;  
H01M008-10; C08L079-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 38

ST ion exchange resin porous **membrane**  
composite fuel cell; fuel cell electrolyte **membrane**  
ion exchanger composite

IT Membranes, nonbiological  
(composite; ion exchange resin-porous  
**membrane** support composite for fuel cell electrolyte)

IT Polyoxyalkylenes, uses  
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)  
(fluorine- and sulfo-containing, ionomers, Nafion, ion exchanger; ion exchange resin-porous **membrane** support composite for fuel cell electrolyte)

IT Fuel cell electrolytes  
Ion exchangers  
(ion exchange resin-porous **membrane**  
support composite for fuel cell electrolyte)

IT Polysulfones, uses  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(polyarylene-polyether-, sulfo-containing, ion exchanger; ion exchange resin-porous **membrane** support composite for fuel cell electrolyte)

IT Polyethers, uses  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(polyarylene-polysulfone-, sulfo-containing, ion exchanger; ion exchange resin-porous **membrane** support composite for fuel cell electrolyte)

IT Fluoropolymers, uses  
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)  
(polyoxyalkylene-, sulfo-containing, ionomers, Nafion, ion exchanger; ion exchange resin-porous **membrane** support composite for fuel cell electrolyte)

IT Ionomers  
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)  
(polyoxyalkylenes, fluorine- and sulfo-containing, Nafion, ion exchanger; ion exchange resin-porous **membrane** support composite for fuel cell electrolyte)

IT Polysulfones, uses  
RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(sulfonated, ion exchanger; ion exchange resin-porous **membrane** support composite for fuel cell electrolyte)

IT Polybenzoxazoles  
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)  
(support; ion exchange resin-porous **membrane** support composite for fuel cell electrolyte)

IT 90960-37-5

RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)

(assumed monomers, support; ion exchange resin-porous membrane support composite for fuel cell electrolyte)

IT 681035-31-4P

RL: DEV (Device component use); IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(ion exchanger; ion exchange resin-porous membrane support composite for fuel cell electrolyte)

IT 582300-03-6, Nafion SE 20192 582300-05-8, Nafion SE 10192

RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)

(ion exchanger; ion exchange resin-porous membrane support composite for fuel cell electrolyte)

IT 60871-72-9 167304-74-7 169836-78-6

RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)

(support; ion exchange resin-porous membrane support composite for fuel cell electrolyte)

L24 ANSWER 4 OF 11 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2004:355275 HCAPLUS

DOCUMENT NUMBER: 140:376230

TITLE: Composite ion exchanger membrane

INVENTOR(S): Kitamura, Kota; Sakaguchi, Yoshimitsu; Nagahara, Shigenori; Hamamoto, Shiro; Takimoto, Naohiko; Sugihara, Hideki; Takase, Satoshi; Kitagawa, Tooru; Saito, Miyako

PATENT ASSIGNEE(S): Toyo Boseki Kabushiki Kaisha, Japan

SOURCE: PCT Int. Appl., 92 pp.

CODEN: PIIXD2

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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WO 2004036679	A1	20040429	WO 2003-JP13278	200310 16

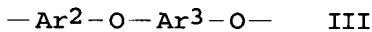
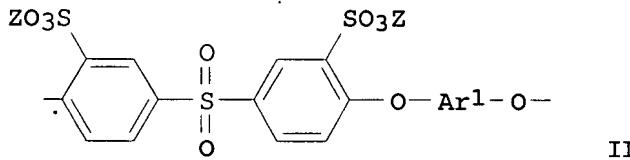
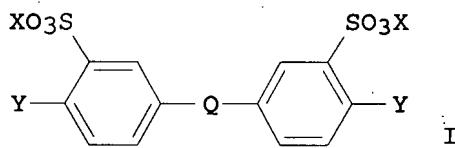
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RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG

JP 2004139836	A	20040513	JP 2002-303289	200210 17
JP 2004139837	A	20040513	JP 2002-303290	200210 17
JP 2004143388	A	20040520	JP 2002-312837	200210 28
JP 2004169003	A	20040617	JP 2003-355364	200310 15
AU 2003273034	A1	20040504	AU 2003-273034	200310 16
US 2006241192	A1	20061026	US 2005-530965	200504 11
PRIORITY APPLN. INFO.:				JP 2002-303289 A 200210 17
				JP 2002-303290 A 200210 17
				JP 2002-312837 A 200210 28
				JP 2002-313025 A 200210 28
				WO 2003-JP13278 W 200310 16

GI



**AB** The **membrane** has **ion exchanger** resin in the continuous through holes in a support **membrane**, where the **ion exchanger** resin contains an aromatic ether and/or its derivative, formed by polymerization of mixture containing monomers

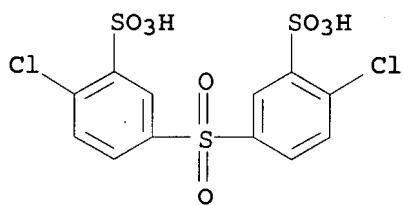
I (Q = -SO<sub>2</sub>- or -CO-, X = H, Li, Na, or K, Y = F, Cl, Br, or I), aromatic dihalides, and bisphenol compound and alkali metal (bi)carbonate. The **ion exchange** resin contain 0-1000 structural units II (Z = H, Li, Na, K, or cation derived from aliphatic or aromatic amines; Ar<sub>1</sub> and Ar<sub>3</sub> = bivalent organic groups, Ar<sub>2</sub> = bivalent organic groups containing ≥1 arom ring having electron attracting group) and 0-1000 structural units III. The composite **membrane** may be used as fuel cell electrolyte.

**IT** 146673-89-4 267877-35-0 681035-31-4  
RL: TEM (Technical or engineered material use); USES (Uses)  
(composite **membranes** containing **ion exchanger** resins in porous polymer support **membranes** for fuel cell electrolytes)

**RN** 146673-89-4 HCPLUS  
**CN** Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with 4,4'-(9H-fluoren-9-ylidene)bis[phenol] and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)

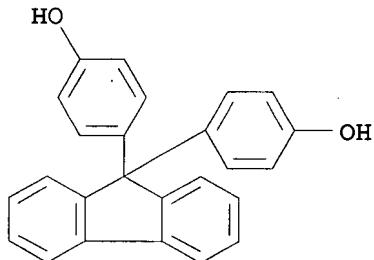
**CM** 1

**CRN** 51698-33-0  
**CMF** C12 H8 Cl2 O8 S3 . 2 Na

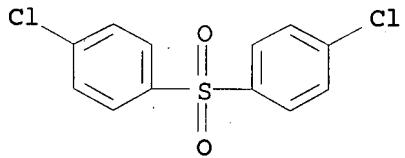


●2 Na

CM 2

CRN 3236-71-3  
CMF C25 H18 O2

CM 3

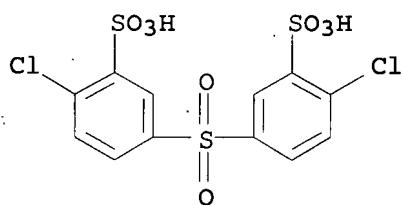
CRN 80-07-9  
CMF C12 H8 Cl2 O2 S

RN 267877-35-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2),  
polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-  
chlorobenzene] (CA INDEX NAME)

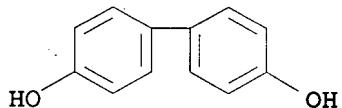
CM 1

CRN 51698-33-0  
CMF C12 H8 Cl2 O8 S3 . 2 Na

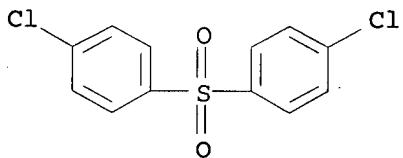


●2 Na

CM 2

CRN 92-88-6  
CMF C12 H10 O2

CM 3

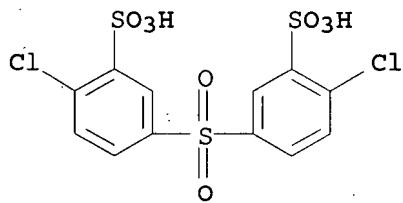
CRN 80-07-9  
CMF C12 H8 Cl2 O2 S

RN 681035-31-4 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2), polymer with [1,1'-biphenyl]-4,4'-diol and 2,6-dichlorobenzonitrile (CA INDEX NAME)

CM 1

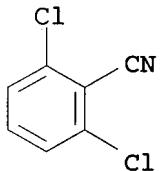
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CMF C12 H8 Cl2 O8 S3 . 2 Na



●2 Na

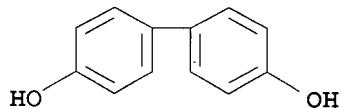
CM 2

CRN 1194-65-6  
CMF C7 H3 Cl2 N



CM 3

CRN 92-88-6  
CMF C12.H10 O2



IC ICM H01M008-02

ICS C08J005-22

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 52

ST composite ion exchanger membrane compn  
fuel cell electrolyte

IT Fuel cell electrolytes  
(composite membranes containing ion  
exchanger resins in porous polymer support  
membranes for fuel cell electrolytes)

IT Polyphosphoric acids  
RL: TEM (Technical or engineered material use); USES (Uses)  
(composite membranes containing ion  
exchanger resins in porous polymer support  
membranes for fuel cell electrolytes)

IT 75-75-2, Methanesulfonic acid 60871-72-9 146673-89-4  
267877-35-0 681035-31-4

IT RL: TEM (Technical or engineered material use); USES (Uses)

(composite membranes containing ion exchanger resins in porous polymer support membranes for fuel cell electrolytes)

L24 ANSWER 5 OF 11 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2003:896528 HCAPLUS

DOCUMENT NUMBER: 140:95080

TITLE: Effect of acidification treatment and morphological stability of sulfonated poly(arylene ether sulfone) copolymer proton-exchange membranes for fuel-cell use above 100°

AUTHOR(S): Kim, Yu Seung; Wang, Feng; Hickner, Michael; Mccartney, Stephan; Hong, Young Taik; Harrison, William; Zawodzinski, Thomas A.; McGrath, James E.

CORPORATE SOURCE: Department of Chemistry and Materials Research Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA

SOURCE: Journal of Polymer Science, Part B: Polymer Physics (2003), 41(22), 2816-2828

CODEN: JPBPEM; ISSN: 0887-6266

PUBLISHER: John Wiley & Sons, Inc.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Directly copolymerd. wholly aromatic sulfonated poly(arylene ether sulfone) copolymers derived from 4,4'-biphenol, 4,4'-dichlorodiphenyl sulfone, 3,3'-disulfonated, and 4,4'-dichlorodiphenyl sulfone (BPSH) were evaluated as proton-exchange membranes for elevated temperature operation (100°-140°). Acidification of the copolymer from the sulfonated form after the nucleophilic step (condensation) copolymer involved either immersing the solvent-cast membrane in sulfuric acid at 30° for 24 h and washing with water at 30° for 24 h (method 1) or immersion in sulfuric acid at 100° for 2 h followed by similar water treatment at 100° for 2 h (method 2). The fully hydrated BPSH membranes treated by method 2 exhibited higher proton conductivity, greater water absorption, and less temperature dependence on proton conductivity as compared with the membranes acidified at 30°.

In contrast, the conductivity and water absorption of a control perfluorosulfonic acid copolymer (Nafion 1135) were invariant with treatment temperature; however, the conductivity of the Nafion membranes at elevated temperature was strongly dependent on heating rate or temperature. Tapping-mode atomic force microscope results demonstrated that all of the membranes exposed to high-temperature conditions underwent an irreversible change of the ionic domain microstructure, the extent of which depended on the concentration of sulfonic acid sites in the BPSH system. The effect of aging membranes based o BPSH and Nafion at elevated temperature on proton conductivity is also discussed.

IT 267877-35-0DP, proton-exchanged

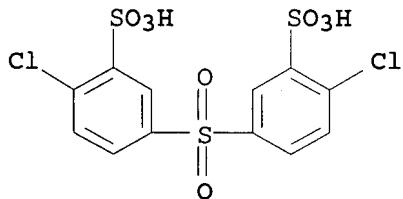
RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
(effect of acidification treatment and morphol. stability of sulfonated poly(arylene ether sulfone) copolymer proton-exchange membranes for fuel-cell use above 100°)

RN 267877-35-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2), polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (CA INDEX NAME)

CM 1

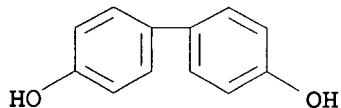
CRN 51698-33-0  
 CMF C12 H8 Cl2 O8 S3 . 2 Na



●2 Na

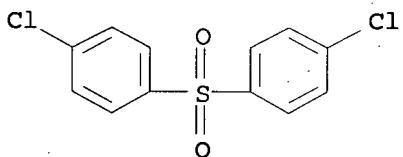
CM 2

CRN 92-88-6  
 CMF C12 H10 O2



CM 3

CRN 80-07-9  
 CMF C12 H8 Cl2 O2 S



CC 38-3 (Plastics Fabrication and Uses)  
 ST sulfonated polyether polysulfone proton exchange membrane  
 morphol acidification treatment; fuel cell sulfonated polyether  
 polysulfone proton exchange membrane conduction  
 IT Fuel cells  
     Ion exchange membranes  
     Polymer morphology  
         (effect of acidification treatment and morphol. stability of  
         sulfonated poly(arylene ether sulfone) copolymer proton-exchange  
         membranes for fuel-cell use above 100°)  
 IT Polysulfones, uses  
     RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or

engineered material use); PREP (Preparation); USES (Uses)  
 (polyether-, aromatic; effect of acidification treatment and  
 morphol. stability of sulfonated poly(arylene ether sulfone)  
 copolymer proton-exchange **membranes** for fuel-cell use  
 above 100°)

## IT Polyethers, uses

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (polysulfone-, aromatic; effect of acidification treatment and  
 morphol. stability of sulfonated poly(arylene ether sulfone)  
 copolymer proton-exchange **membranes** for fuel-cell use  
 above 100°)

## IT Ionic conductivity

(proton; effect of acidification treatment and morphol. stability  
 of sulfonated poly(arylene ether sulfone) copolymer  
 proton-exchange **membranes** for fuel-cell use above  
 100°)

## IT Absorption

(water; effect of acidification treatment and morphol. stability  
 of sulfonated poly(arylene ether sulfone) copolymer  
 proton-exchange **membranes** for fuel-cell use above  
 100°)

## IT 267877-35-0DP, proton-exchanged

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (effect of acidification treatment and morphol. stability of  
 sulfonated poly(arylene ether sulfone) copolymer proton-exchange  
**membranes** for fuel-cell use above 100°)

REFERENCE COUNT: 32 THERE ARE 32 CITED REFERENCES AVAILABLE  
 FOR THIS RECORD. ALL CITATIONS AVAILABLE  
 IN THE RE FORMAT

L24 ANSWER 6 OF 11 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2003:644802 HCPLUS

DOCUMENT NUMBER: 139:339981

TITLE: Processing induced morphological development in  
 hydrated sulfonated poly(arylene ether sulfone)  
 copolymer **membranes**

AUTHOR(S): Kim, Yu Seung; Dong, Limin; Hickner, Michael A.;  
 Pivovar, Bryan S.; McGrath, James E.

CORPORATE SOURCE: Department of Chemistry and Institute for  
 Polymeric Materials and Interfaces, Virginia  
 Polytechnic Institute and State University,  
 Blacksburg, VA, 24061, USA

SOURCE: Polymer (2003), 44(19), 5729-5736  
 CODEN: POLMAG; ISSN: 0032-3861

PUBLISHER: Elsevier Science Ltd.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB The development of morphol. solid-state structures in sulfonated  
 poly(arylene ether sulfone) copolymers (acid form) by hydrothermal  
 treatment was investigated by water uptake, dynamic mech. anal.  
 (DMA), and tapping mode atomic force microscopy (TM-AFM). The water  
 uptake and DMA studies suggested that the materials have 3  
 irreversible morphol. regimes, whose intervals are controlled by  
 copolymer composition and hydrothermal treatment temperature Ambient temperature  
 treatment of the **membranes** afforded a structure denoted as  
 Regime1. When the copolymer **membranes** were exposed to a  
 higher temperature, AFM revealed a morphol. (Regime2) where the phase  
 contrast and domain connectivity of the hydrophilic phase of the

copolymers were greatly increased. A yet higher treatment temperature was defined which yielded a third regime, likely related to viscoelastic relaxations associated with the hydrated glass transition temperature (hydrated Tg). The required temps. needed to produce transitions from Regime1 to Regime2 or Regime3 decreased with increasing degree of disulfonation. These temps. correspond to the percolation and hydrogel temps., resp. Poly(arylene ether sulfone) copolymer membranes with a 40% disulfonation in Regime2 under fully hydrated conditions showed similar proton conductivity (.apprx.0.1 S/cm) to the well-known perfluorinated copolymer Nafion 1135 but exhibited higher modulus and water uptake. The proton conductivity and storage modulus are discussed in terms of each of the morphol. regimes and compared with Nafion 1135. The results are of particular interest for either hydrogen or direct methanol fuel cells where conductivity and membrane permeability are critical issues.

IT 267877-35-0DP, hydrolyzed

RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)

(solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange membranes induced by hydrothermal treatment)

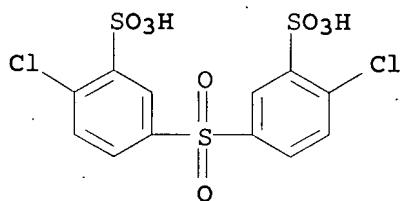
RN 267877-35-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2), polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

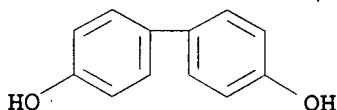


●2 Na

CM 2

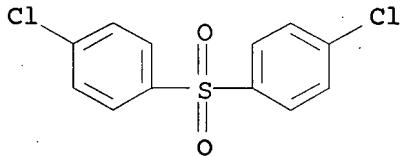
CRN 92-88-6

CMF C12 H10 O2



CM 3

CRN 80-07-9  
CMF C12 H8 Cl2 O2 S



- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
Section cross-reference(s): 38
- ST sulfonated polyether polysulfone **membrane** hydrothermal treatment morphol proton cond
- IT Polysulfones, preparation  
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)  
(polyether-, aromatic; solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange **membranes** induced by hydrothermal treatment)
- IT Polyethers, preparation  
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)  
(polysulfone-, aromatic; solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange **membranes** induced by hydrothermal treatment)
- IT Ion exchange membranes  
Ionic conductivity  
(proton; solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange **membranes** induced by hydrothermal treatment)
- IT Glass transition temperature  
Polymer morphology  
Storage modulus  
(solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange **membranes** induced by hydrothermal treatment)
- IT Ionomers  
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)  
(solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange **membranes** induced by hydrothermal treatment)
- IT Deformation (mechanical)  
(tensile; solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange **membranes** induced by hydrothermal treatment)
- IT Relaxation  
(viscoelastic; solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange **membranes** induced by hydrothermal treatment)
- IT Adsorption  
(water; solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange **membranes** induced by hydrothermal treatment)
- IT 267877-35-0DP, hydrolyzed  
RL: PRP (Properties); SPN (Synthetic preparation); PREP

## (Preparation)

(solid-state morphol. of sulfonated poly(arylene ether sulfone) copolymer proton exchange membranes induced by hydrothermal treatment)

REFERENCE COUNT: 25 THERE ARE 25 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L24 ANSWER 7 OF 11 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2003:560877 HCAPLUS

DOCUMENT NUMBER: 139:292987

TITLE: An investigation of proton conduction in select PEM's and reaction layer interfaces-designed for elevated temperature operation

AUTHOR(S): Ma, Chengsong; Zhang, Lei; Mukerjee, Sanjeev; Ofer, David; Nair, Bindu

CORPORATE SOURCE: Department of Chemistry, Northeastern University, Boston, MA, 02115, USA

SOURCE: Journal of Membrane Science (2003), 219(1-2), 123-136

CODEN: JMESDO; ISSN: 0376-7388

PUBLISHER: Elsevier Science B.V.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB The proton conductivity of several alternative proton exchange membranes, i.e. SPES-40 (a sulfonated polyarylene ether sulfone), SPSS-40 (sulfonated polysulfide sulfone) and SPES-PS (a polyether sulfone post-sulfonated) were studied using a four-probe ac-impedance method as a function of temperature. Further, proton conductivity was also investigated for the same ionomers in the form of micro-aggregates such as those typically encountered in the reaction layer (the interfacial layer of the electrode containing the catalyst). For this a new configuration of the conventional reaction layer in a membrane electrode assembly (MEA) was used, which enabled the isolation of proton conductivity to be the principle contributor to the ac-impedance. The results under 100% relative humidity, showed that SPES-40 has similar proton conductivity as Nafion in the membrane within our exptl. conditions. The values for the other membranes investigated were lower. Attempts to correlate these observed differences with parameters such as equivalent weight (EW), water uptake ( $\lambda$ ), acidity (pKa), etc. showed that the prime contributor was the difference in microstructure of the membranes. Conductivity of these polymeric ionomers when present as micro-aggregates in the reaction layer showed very different values as compared to the bulk membranes. There was a great divergence in conduction as a function of increase in temperature with Nafion showed a far greater rate of increase of conductivity than SPES-50 and SPES-PS. Blends of these ionomers with Nafion showed intermediate values, albeit lower with characteristics closer to Nafion. Single cell PEM polarization curves were measured for both Nafion 117 and SPES-40 membrane keeping the ionomer in the reaction layer same as the membrane. Comparison of the performance showed similar ohmic polarization characteristics. However, their performance in the low c.d. activation polarization region indicated poorer oxygen reduction reaction kinetics with SPES-40 material as compared to Nafion.

IT 267877-35-0

RL: PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)

(proton conduction in proton exchange membranes and  
high-temperature reaction layer interfaces for fuel cells)

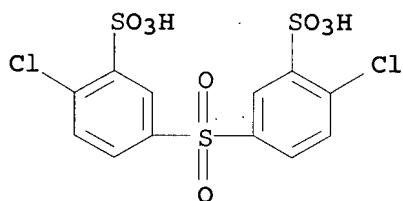
RN 267877-35-0 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2),  
polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-  
chlorobenzene] (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

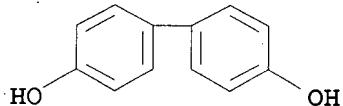


●2 Na

CM 2

CRN 92-88-6

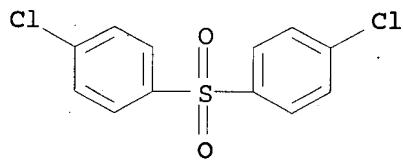
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 Cl2 O2 S



CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 52

ST fuel cell proton exchange membrane interface proton cond

IT Polysulfones, uses

RL: PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); TEM (Technical or engineered

- material use); PROC (Process); USES (Uses)  
 (polyether-; proton conduction in proton exchange  
**membranes** and high-temperature reaction layer interfaces for  
 fuel cells)
- IT Polythioethers  
 RL: PEP (Physical, engineering or chemical process); PRP  
 (Properties); PYP (Physical process); TEM (Technical or engineered  
 material use); PROC (Process); USES (Uses)  
 (polysulfone-, sulfonated; proton conduction in proton exchange  
**membranes** and high-temperature reaction layer interfaces for  
 fuel cells)
- IT Polyethers, uses  
 RL: PEP (Physical, engineering or chemical process); PRP  
 (Properties); PYP (Physical process); TEM (Technical or engineered  
 material use); PROC (Process); USES (Uses)  
 (polysulfone-; proton conduction in proton exchange  
**membranes** and high-temperature reaction layer interfaces for  
 fuel cells)
- IT Polysulfones, uses  
 RL: PEP (Physical, engineering or chemical process); PRP  
 (Properties); PYP (Physical process); TEM (Technical or engineered  
 material use); PROC (Process); USES (Uses)  
 (polythioether-, sulfonated; proton conduction in proton exchange  
**membranes** and high-temperature reaction layer interfaces for  
 fuel cells)
- IT Cation exchange membranes  
 Fuel cells  
 Interface  
 (proton conduction in proton exchange **membranes** and  
 high-temperature reaction layer interfaces for fuel cells)
- IT Ionomers  
 RL: PEP (Physical, engineering or chemical process); PRP  
 (Properties); PYP (Physical process); TEM (Technical or engineered  
 material use); PROC (Process); USES (Uses)  
 (proton conduction in proton exchange **membranes** and  
 high-temperature reaction layer interfaces for fuel cells)
- IT Ionic conductivity  
 (proton; proton conduction in proton exchange **membranes**  
 and high-temperature reaction layer interfaces for fuel cells)
- IT 25839-81-0D, Radel R, sulfonated 66796-30-3, Nafion 117  
 267877-35-0  
 RL: PEP (Physical, engineering or chemical process); PRP  
 (Properties); PYP (Physical process); TEM (Technical or engineered  
 material use); PROC (Process); USES (Uses)  
 (proton conduction in proton exchange **membranes** and  
 high-temperature reaction layer interfaces for fuel cells)
- REFERENCE COUNT: 37 THERE ARE 37 CITED REFERENCES AVAILABLE  
 FOR THIS RECORD. ALL CITATIONS AVAILABLE  
 IN THE RE FORMAT

L24 ANSWER 8 OF 11 HCAPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2003:326153 HCAPLUS  
 DOCUMENT NUMBER: 139:101749  
 TITLE: Electrochemical characterization of sulfonated  
 poly(arylene ether sulfone) (S-PES)  
 cation-exchange  
**membranes**  
 AUTHOR(S): Kang, Moon-Sung; Choi, Yong-Jin; Choi, Ik-Jun;  
 Yoon, Tae-Ho; Moon, Seung-Hyeon  
 CORPORATE SOURCE: Department of Environmental Science and

Engineering, Kwang-Ju Institute of Science and Technology (K-JIST), Buk-gu, Gwangju, 500-712, S. Korea

SOURCE: Journal of Membrane Science (2003), 216(1-2), 39-53

CODEN: JMESDO; ISSN: 0376-7388

PUBLISHER: Elsevier Science B.V.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Sulfonate poly(arylene ether sulfone) (S-PES) **cation-exchange membranes** with various degrees of sulfonation were prepared via direct polymerization of sulfonate monomer and characterized in terms of electrochem. properties, including surface heterogeneity and current-voltage (I-V) relation. The S-PES **membranes** exhibited moderate swelling and **ion-exchange capacity (IEC)** suitable for **electro-membrane** applications. The **membranes** with mole ratio of sulfonate group of over 40% showed excellent electrochem. properties. The elec. resistance is below 1.0 Ω cm<sup>2</sup> in 0.5 mol dm<sup>-3</sup> NaCl electrolyte and the ionic permselectivity of the **membranes** is comparable to that of com. **membranes**. The fraction of conducting regions, .vepsiln., on the **membrane** surface was evaluated through a chronopotentiometry. The .vepsiln. of S-PES **membranes** was higher than that of sulfonated poly(arylene ether sulfone) **membranes** prepared via conventional post-sulfonation, leading to low elec. resistance and high ionic permselectivity.

IT 267877-35-0P, 4,4'-Biphenol-4,4'-dichlorodiphenyl sulfone-disodium 3,3'-sulfonylbis(6-chlorobenzenesulfonate) copolymer

RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)  
(elec. resistance and ion permselectivity and redox potential of sulfonated poly(arylene ether sulfone) for use as **cation-exchange membrane**)

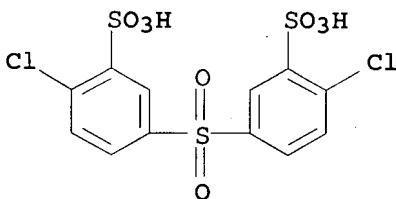
RN 267877-35-0 HCAPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2), polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (CA INDEX NAME)

CM 1

CRN 51698-33-0

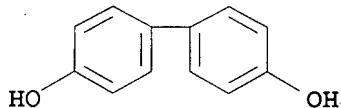
CMF C12 H8 Cl2 O8 S3 . 2 Na



●2 Na

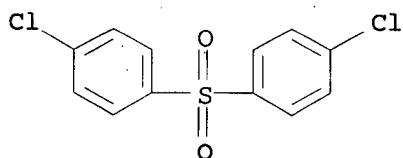
CM 2

CRN 92-88-6  
 CMF C12 H10 O2



CM 3

CRN 80-07-9  
 CMF C12 H8 Cl2 O2 S



- CC 37-5 (Plastics Manufacture and Processing)  
 Section cross-reference(s): 38, 72
- ST sulfonated polyarylene ether sulfone swelling ion exchange capacity; cation exchange membrane sulfonated polyarylene polyether polysulfone
- IT Cation exchange  
 Electric resistance  
 Redox potential  
 Swelling, physical  
 Tensile strength  
 (elec. resistance and ion permselectivity and redox potential of sulfonated poly(arylene ether sulfone) for use as cation-exchange membrane)
- IT Polysulfones, preparation  
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)  
 (polyether-; elec. resistance and ion permselectivity and redox potential of sulfonated poly(arylene ether sulfone) for use as cation-exchange membrane)
- IT Polyethers, preparation  
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)  
 (polysulfone-; elec. resistance and ion permselectivity and redox potential of sulfonated poly(arylene ether sulfone) for use as cation-exchange membrane)
- IT Permeability  
 (selective; elec. resistance and ion permselectivity and redox potential of sulfonated poly(arylene ether sulfone) for use as cation-exchange membrane)
- IT Electric conductivity  
 (surface, selective; elec. resistance and ion permselectivity and redox potential of sulfonated poly(arylene ether sulfone) for use as cation-exchange membrane)

IT 267877-35-0P, 4,4'-Biphenol-4,4'-dichlorodiphenyl sulfone-disodium 3,3'-sulfonylbis(6-chlorobenzenesulfonate) copolymer  
 RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)  
 (elec. resistance and ion permselectivity and redox potential of sulfonated poly(arylene ether sulfone) for use as cation -exchange membrane)

REFERENCE COUNT: 29 THERE ARE 29 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L24 ANSWER 9 OF 11 HCAPLUS COPYRIGHT 2007 ACS on STN  
 ACCESSION NUMBER: 2002:241166 HCAPLUS  
 DOCUMENT NUMBER: 136:265821  
 TITLE: Ion-conducting sulfonated polymeric materials  
 INVENTOR(S): McGrath, James E.; Hickner, Michael; Wang, Feng;  
 Kim, Yu-Seung  
 PATENT ASSIGNEE(S): Virginia Tech Intellectual Properties, Inc., USA  
 SOURCE: PCT Int. Appl., 46 pp.  
 CODEN: PIXXD2  
 DOCUMENT TYPE: Patent  
 LANGUAGE: English  
 FAMILY ACC. NUM. COUNT: 2  
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2002025764	A1	20020328	WO 2001-US29293	200109 20
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG		<--		
CA 2421627	A1	20020328	CA 2001-2421627	200109 20
AU 200192804	A	20020402	AU 2001-92804	200109 20
EP 1327278	A1	20030716	EP 2001-973199	200109 20
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR JP 2004509224	T	20040325	JP 2002-528869	200109 20

PRIORITY APPLN. INFO.:

<--

US 2000-234177P P  
200009  
20

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WO 2001-US29293 W  
200109  
20

**AB** Sulfonated polymers are made by the direct polymerization of a sulfonated monomer to form the sulfonated polymers. The types of sulfonated polymers may include polysulfones or polyimides. The sulfonated polymers can be formed into **membranes** that may be used in proton exchange **membrane** fuel cells or as **ion exchange membranes**. The **membranes** formed from the sulfonated polymers exhibit improved properties over that of Nafion. A heteropoly acid may be added to the sulfonated polymer to form a nanocomposite **membrane** in which the heteropoly acid is highly dispersed. The addition of a heteropoly acid to the sulfonated polymer increases the thermal stability of the **membrane**, enhances the conductivity above 100°, and reduces the water uptake of the **membrane**.

**IT** 267877-35-0P

RL: DEV (Device component use); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(ion-conducting sulfonated polymeric materials)

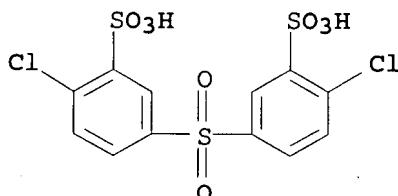
**RN** 267877-35-0 HCPLUS

**CN** Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2), polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

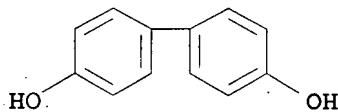


●2 Na

CM 2

CRN 92-88-6

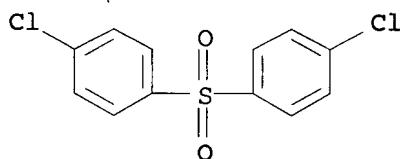
CMF C12 H10 O2



CM 3

CRN 80-07-9

CMF C12 H8 Cl2 O2 S



IC ICM H01M008-10

ICS C08G069-26; C08G075-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s): 37

ST fuel cell **membrane** sulfonated polymer heteropoly acid  
nanocomposite; ion **exchange membrane**

sulfonated polymer heteropoly acid nanocomposite

IT **Ion exchange membranes**  
(ion-conducting sulfonated polymeric materials)IT Fuel cells  
(proton **exchange membrane**; ion  
conducting sulfonated polymeric materials)IT 267877-35-0P 302924-87-4DP, proton **exchanged**  
derivs. 302924-87-4PRL: DEV (Device component use); SPN (Synthetic preparation); TEM  
(Technical or engineered material use); PREP (Preparation); USES  
(Uses)

(ion-conducting sulfonated polymeric materials)

REFERENCE COUNT: 3 THERE ARE 3 CITED REFERENCES AVAILABLE FOR  
THIS RECORD. ALL CITATIONS AVAILABLE IN  
THE RE FORMAT

L24 ANSWER 10 OF 11 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2002:93463 HCPLUS

DOCUMENT NUMBER: 136:310780

TITLE: Direct polymerization of sulfonated poly(arylene  
ether sulfone) random (statistical) copolymers:  
candidates for new proton exchange  
**membranes**AUTHOR(S): Wang, Feng; Hickner, Michael; Kim, Yu Seung;  
Zawodzinski, Thomas A.; McGrath, James E.CORPORATE SOURCE: Department of Chemistry and Materials Research  
Institute, Virginia Polytechnic Institute and  
State University, Blacksburg, VA, 24061, USASOURCE: Journal of Membrane Science (2002),  
197(1-2), 231-242CODEN: JMESDO; ISSN: 0376-7388  
Elsevier Science B.V.

DOCUMENT TYPE: Journal  
 LANGUAGE: English

AB Novel biphenol-based wholly aromatic poly(arylene ether sulfone)s containing up to two pendant sulfonate groups per repeat unit were prepared by potassium carbonate mediated direct aromatic nucleophilic substitution polycondensation of disodium 3,3'-disulfonate-4,4'-dichlorodiphenylsulfone (SDCDPS), 4,4'-dichlorodiphenylsulfone (DCDPS) and 4,4'-biphenol. Copolymer proceeded quant. to high mol. weight in N-methyl-2-pyrrolidinone at 190 °C. Tough membranes with a SDCDPS/DCDPS mole ratio up to 60:40 were successfully cast using N,N-dimethylacetamide. An increase of sulfonate groups in the copolymer resulted in increased glass transition temperature, enhanced membrane hydrophilicity, and intrinsic viscosity; the 100% SDCDPS homopolymer was water soluble. The acid form membranes were successfully obtained by treating the sodium form of the membranes with dilute sulfuric acid solution. Thermogravimetric anal. shows that the sodium form materials have enhanced thermal stability relative to the acid form, as expected. Atomic force microscopy (AFM) phase images of the acid form membranes clearly show the hydrophilic domains, with sizes increasing from 10 to 25 nm as a function of the degree of sulfonation. A phase inversion could be observed for the 60% SCSDPS copolymer, which was consistent with a rapid increase in water absorption. Short-term aging (30 min) indicates that the desired acid form membranes are stable to 220 °C in air and conductivity values at 30 °C of 0.11 S/cm (SDCDPS/DCDPS=0.4) and 0.17 S/cm (SDCDPS/DCDPS=0.6) were measured, which are comparable to or higher than the state-of-the-art fluorinated copolymer Nafion 1135 control (0.12 S/cm). The conductivity is greatly influenced by ion exchange capacity, temperature, and water activity. The new copolymers, which contain ion conductivity sites on the deactivated positions of the aryl backbone rings, are candidates as new polymeric electrolyte materials for proton exchange membrane (PEM) fuel cells.

IT 267877-35-0P

RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); RACT (Reactant or reagent); USES (Uses)  
 (preparation, thermal, elec., and rheol... properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

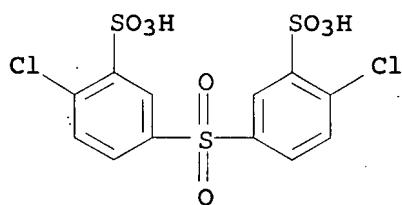
RN 267877-35-0 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2), polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (CA INDEX NAME)

CM 1

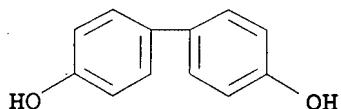
CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

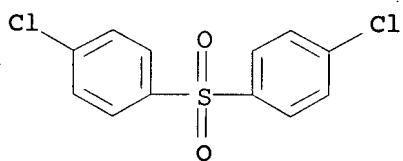


●2 Na

CM 2

CRN 92-88-6  
CMF C12 H10 O2

CM 3

CRN 80-07-9  
CMF C12 H8 Cl2 O2 S

IT 267877-35-0DP, hydrolyzed

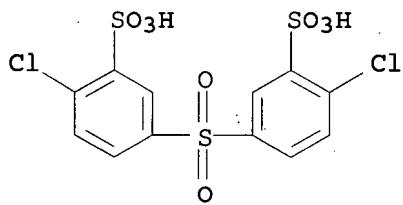
RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (preparation, thermal, elec., and rheol.. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

RN 267877-35-0 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, sodium salt (1:2), polymer with [1,1'-biphenyl]-4,4'-diol and 1,1'-sulfonylbis[4-chlorobenzene] (CA INDEX NAME)

CM 1

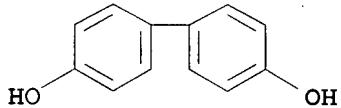
CRN 51698-33-0  
CMF C12 H8 Cl2 O8 S3 . 2 Na



●2 Na

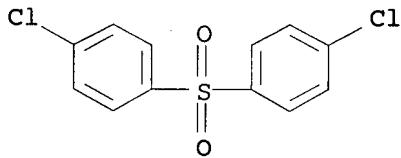
CM 2

CRN 92-88-6  
CMF C12 H10 O2



CM 3

CRN 80-07-9  
CMF C12 H8 Cl2 O2 S



- CC 38-3 (Plastics Fabrication and Uses)  
Section cross-reference(s): 35
- ST nucleophilic substitution polycondensation disodium  
disulfonatodichlorodiphenylsulfone dichlorodiphenylsulfone biphenol  
potassium carbonate; polyether polysulfone **membrane** prep
- IT Electric conductivity  
Glass transition temperature  
**Membranes**, nonbiological  
Thermal stability  
Viscosity  
(preparation, thermal, elec., and rheol.. properties of sulfonated  
poly(arylene ether sulfone) as candidates for new proton exchange  
**membranes**)
- IT Adsorption  
(water; preparation, thermal, elec., and rheol.. properties of  
sulfonated poly(arylene ether sulfone) as candidates for new  
proton exchange **membranes**)
- IT 584-08-7, Potassium carbonate

RL: CAT (Catalyst use); USES (Uses)  
 (preparation, thermal, elec., and rheol.. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

IT 267877-35-0P

RL: PRP (Properties); RCT (Reactant); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); RACT (Reactant or reagent); USES (Uses)  
 (preparation, thermal, elec., and rheol.. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

IT 267877-35-0DP, hydrolyzed

RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)  
 (preparation, thermal, elec., and rheol.. properties of sulfonated poly(arylene ether sulfone) as candidates for new proton exchange membranes)

REFERENCE COUNT:

37

THERE ARE 37 CITED REFERENCES AVAILABLE  
 FOR THIS RECORD. ALL CITATIONS AVAILABLE  
 IN THE RE FORMAT

L24 ANSWER 11 OF 11 HCPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1993:409381 HCPLUS

DOCUMENT NUMBER: 119:9381

TITLE: heat-resistant sulfonated polysulfones

INVENTOR(S): Harada, Yoshiyuki; Teramoto, Takeo

PATENT ASSIGNEE(S): Nippon Steel Corp., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 4 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

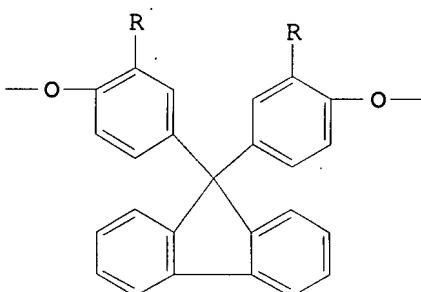
PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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JP 05001149	A	19930108	JP 1991-178920	199106 25

PRIORITY APPLN. INFO.: JP 1991-178920

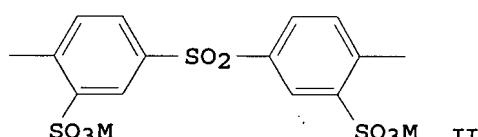
199106  
25

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GI



I



II

AB Title polysulfones with controllable sulfonation ratio and good yield, useful as materials of **ion-exchange** resins and separation **membranes**, have repeating units  $(XY)_m(XZ)_n$  [X = I (R = H, Me, Et); Y = -p-C<sub>6</sub>H<sub>4</sub>SO<sub>2</sub>-p-C<sub>6</sub>H<sub>4</sub>-; Z = II (M = H, alkali metal, tetraalkylammonium); m, n = repeating number; Y/Z mol ratio 99/1-1/100] and inherent viscosity 0.3-3.0. Thus, 9,9-bis(4-hydroxyphenyl)fluorene 20, 4,4'-dichlorodiphenyl sulfone 19, and di-Na 4,4'-dichlorodiphenyl sulfone-3,3'-disulfonate 1 mmol were mixed with K<sub>2</sub>CO<sub>3</sub>, dimethylacetamide, toluene, dehydrated, and treated at 120° for 15 h and at 160° for 24 h to give a sulfonated polysulfone with Y/Z mol ratio 95/5, yield 100%, inherent viscosity 0.86 dL/g, **ion-exchange** volume 0.14 meq/g, and water contact angle 69.6° (air side) and 61.5° (glass surface side).

IT 146673-89-4P

RL: PREP (Preparation)  
(preparation of, heat-resistant, for **ion-exchange** resins and separation **membranes**)

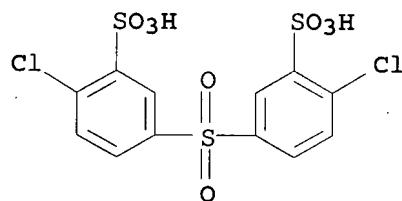
RN 146673-89-4 HCPLUS

CN Benzenesulfonic acid, 3,3'-sulfonylbis[6-chloro-, disodium salt, polymer with 4,4'-(9H-fluoren-9-ylidene)bis[phenol] and 1,1'-sulfonylbis[4-chlorobenzene] (9CI) (CA INDEX NAME)

CM 1

CRN 51698-33-0

CMF C12 H8 Cl2 O8 S3 . 2 Na

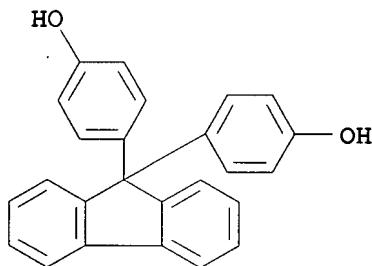


●2 Na

CM 2

CRN 3236-71-3

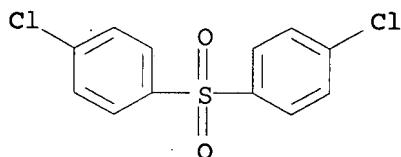
CMF C25 H18 O2



CM 3

CRN 80-07-9

CMF C12 H8 Cl2 O2 S



IC ICM C08G075-20

CC 35-5 (Chemistry of Synthetic High Polymers)  
Section cross-reference(s): 38ST heat resistance sulfonated polysulfone; ion  
exchange resin sulfonated polysulfone; sepn membrane  
sulfonated polysulfoneIT Ion exchangers  
(sulfonated polysulfones for, heat-resistant)IT Membranes  
(sulfonated polysulfones, heat-resistant)IT Heat-resistant materials  
(sulfonated polysulfones, preparation of, for ion-  
exchange resins and separation membranes)

IT Polysulfones, compounds

RL: PREP (Preparation)  
(sulfonated, preparation of, heat-resistant, for ion-  
exchange resins and separation membranes)

IT 146673-89-4P

RL: PREP (Preparation)  
(preparation of, heat-resistant, for ion-exchange  
resins and separation membranes)

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